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NATURAL HISTORY.—*The codfishes of the Greeks and Romans.**

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The codfish family, comprising the gadoids, is a large and important one. In it belong such fishes as the cod, the hake, the haddock, the whiting, the eglefin, the poutassou, the ling, the burbot, the dorse, the coalfish, the pollack, and the bib or pout. Some of these fishes do not occur in the Mediterranean today and therefore presumably were not familiar to the Greeks and Romans. But some are very common in that sea and must have been of considerable economic importance in ancient times.

But a scholar, whether he is an ichthyologist or a classical philologist, will look in vain for a comprehensive discussion of this family. He will find some data in notes on the names of gadoids occurring in certain works of ancient authors, some in etymological articles and reference works, and some in books that deal with classical zoology. There is a short article by Marx in an early volume of Pauly-Wissowa-Kroll-Mittelhaus on the asellus[1] and an equally brief one by Steier in a later volume of the same encyclopedia on the mustela.[2] The former is much out of date, and the two taken together deal with only a portion of the names applied to gadoids. The most valuable of recent reference works concerned with identifications is Sir D'Arcy W. Thompson's *A glossary of Greek fishes*,[3] frequently cited in this article. Its chief drawback is that the alphabetical organization of the material creates a research problem of no mean scope for a scholar who desires information about a particular family or genus of fishes, since the index is incomplete.

As matters now stand, a scholar seeking information regarding codfishes in ancient times is faced with two serious difficulties. The first is that unless he knows before he begins what names were applied or may have been applied to members of this group, he will make little progress. The second is that the meanings assigned to these names are often vague and in some cases actually erroneous.

The present article represents, so far as can be ascertained, the first attempt to treat this family of fishes as a unit, with discussion of every Greek and Latin name that was or may have been applied to gadoids. This treatment not only makes the relevant information available in convenient and readily accessible form but also it yields more precise meanings for the names themselves. This results from study of these names in relation to one another rather than as isolated terms. Consequently, the identifications of Greek fish names in particular will be found to differ frequently from those of Thompson and from those given in the *Greek-English lexicon* of Liddell-Scott-Jones.

1. MUSTELA

The mustela or "weaselfish" of the Romans has generally been identified as the cod, more particularly the 5-bearded rockling, *Gadus* (*Motella*) *mustela* Linnaeus, although the modern nomenclature suggests that ancient usage was not confined to this species.

The Mediterranean hake, *Phycis mediterraneus*

* Received August 26, 1948.

[1] *Real-Encyclopädie der classischen Altertumswissenschaft* **2**: 1532–1533. 1896.

[2] *Idem*, **16**: 907–908. 1933.

[3] London, Oxford University Press, 1947.

De la Roche, is known today as musdea at Pola and as musdea and musdeca at Rome[4]; and such names have earlier been reported as moustelo at Marseille (Marion), moustella bruna at Nice (Risso), mustella de scheuggio at Genoa (Sassi), musdea at Naples (Costa), and musdea di funnu in Sicily (Döderlein).[5]

The fork-beard hake, *Phycis blennioides* Bloch and Schneider, is also called musdea and musdeca at Rome,[6] and such earlier names have been reported as moustelo blanc and moustelo de roco in the Provence (Réguis), moustèle at Marseille (Brünnich), moustella blanca at Nice (Risso), mustella at Genoa (Sassi), mustià at Cagliari (Targioni), and mustea and mustià at Palermo (Döderlein).[7]

The 3-bearded rockling, *Motella tricirrata* Nilsson, is also known as musdea and musdeca at Rome, musdea at Catanzaro, and mostella at Livorno.[8] Scholars have previously reported such names as mostel at Mallorca (Barcelo), moustelo in the Provence (Réguis), moustelo at Marseille (Marion), moustella at Nice (Risso), mostella at Genoa (Targioni), musdea de funnale at Naples (A. Costa), and mustedda and mustiddu in Sicily (Rafinesque).[9]

For *Motella maculata* Günther such names have been reported as moustello at Nice (Risso) and moustelo in the Provence (Réguis).[10]

For *Motella fusca* Bonaparte such names have been reported as mostel at Mallorca (Barcelo), moustela at Nice (Risso), musdea de scoglio for the male and musdea de fangu for the female at Naples, as well as musdea de funnu (Costa).[11]

And for *Uraleptus maraldi* Costa such names have been reported as moustella negra (Risso) and moustelo negro (Réguis) at Nice.[12]

In addition, it may be noted that Larousse defines French moustèle as a generic term for *Motella* sp.

The modern names that come from mustela obviously do not apply to a single species but to several closely related ones, more especially *Phycis* sp. and *Motella* sp. This does not, however, justify an immediate conclusion that mustela in the classical era had a similarly diverse application. The history of fish names reflects a tendency for an originally limited application to spread to other closely related and similar fishes. The modern nomenclature does, however, exhibit two noteworthy features. The first is that there have been only sporadic survivals of mustela, found almost exclusively along the shores of the Tyrrhenian and Ligurian Seas, more especially at Marseille, Nice, Genoa, Rome, Naples, and Palermo. This suggests that in the classical period the use of mustela in the speech of the common people was probably largely confined to that area. . The second is that these survivals do not predominate for any one species but are applied in approximately equal degree to various species of *Phycis* and *Motella*. Generally, when a name which was once narrowly restricted in application spread to other species, the survivals in modern nomenclature contain a clue to the original application. Those which are applied to other than the original species tend to be less numerous and also to be qualified in some way. Neither tendency is clearly manifest in this instance, and this gives some basis for believing that Latin mustela similarly did not refer specifically to *Gadus* (*Motella*) *mustela*, but to several closely related species, more especially *Phycis* sp. and *Motella* sp.

The mustela discussed above is the one which Ennius[13] considered superior to all other fishes when caught at Clipea and Pliny[14] ranked second only to the scarus (the parrotfish, *Scarus cretensis* Cuvier and Valenciennes) in his time, although it was esteemed chiefly for its liver. But when Pliny says that *mirum dictu* there was a mustela in the Lake of Constance which in excellence of taste compared favorably with the marine mustela, he is referring to the burbot or eelpout, *Lota vulgaris* Cuvier, which even today attains unusual excellence in the same lake. Finds at Robenhausen testify to use of this fish for food as early as the prehistoric period.[15] It has long been

[4] Cf. *La pesca nei mari e nelle acque interne d'Italia*, Ministerio dell' Agricoltura e delle Foreste, Roma, Istituto Poligrafico dello Stato, **3**: 80, 84. 1931.

[5] Cf. Julius V. Carus, *Prodromus faunae mediterraneae* **2**: 575–576. Stuttgart, 1885–93.

[6] Cf. *La pesca nei mari* **3**: 80.

[7] Cf. Carus, *op. cit.*, **2**: 575.

[8] Cf. *La pesca nei mari* **3**: 83, 51, 62.

[9] Cf. Carus, *op. cit.*, **2**: 577.

[10] *Ibid.*: 578.

[11] *Ibid.*

[12] *Ibid.*: 574.

[13] *Heduph.* 1 (apud Apul. *Apol.* 39). Thompson (*op. cit.*: 169) thinks that this may be the lamprey. His identification seems to depend in part upon taking Clupea to be a fish name rather than a place name. E. H. Warmington (*Remains of Old Latin*, Loeb Classical Library, **1**: 409, note a) similarly would read *clupeis* for *Clupea* and take it as the tiny fresh-water fish described by Pliny (*N.H.* 9.44).

[14] *N.H.* 9.63.

[15] Cf. L. Rütimeyer, "Die Fauna der Pfahlbauten in der Schweiz," Neue Denkschr. allg. Schweiz. Ges. Naturw., **19**: 114. 1862.

esteemed as a great delicacy, but more on the continent than in England. The flesh is white and delicate, the liver being the most delicious morsel.[16] This species also occurs in lakes of northern Italy, where it is known by such names as bottatrice (dial. bottris, boza) at Milan, bottratrice at Brescia, and bottatrice (dial. bosa trisa) at Verona.[17] Bottatrice is apparently a compound of botta with trische (trüsche), the second element being the more common name of this species in German Switzerland.[18] The first appearance of *lotta as a name for the burbot is in the tenth century. This is evidently a Gallic word, the source of French lotte and Spanish and Portuguese lota.[19] Ausonius[20] describes the mustela and speaks of it as occurring in the Donau and the Moselle rather than in the Lake of Constance. His mustela may also be the burbot,[21] although it has been identified by some as the lampern or lamper-eel, *Petromyzon fluviatilis* Linnaeus,[22] which is regarded by many epicures as a real delicacy. Neither identification is wholly satisfactory.[23] Columella's allusion to the voracity of the *mustela*[24] also suggests the burbot, which is a notorious fish of prey, although Thompson[25] thinks that it may be the lamprey. The burbot is a close relative of the cod and hake, classified by Linnaeus as a *Gadus*, and the tendency of the Romans to refer to it by the same name is therefore understandable.

2. Γαλῆ

Greek γαλῆ, like Latin mustela, means "weaselfish." Aristotle[26] speaks of a γαλεός with many pyloric caeca, which led Schneider to emend to γαλῆ,[27] a change approved by Hoffman.[28] This emendation was motivated by the fact that γαλεός was the usual term for a dogfish, which has no pyloric appendages, whereas the Gadidae do. That a copyist's error of this sort should have occurred is comprehensible, since γαλεός was a more common fish name than γαλῆ. It is noteworthy, moreover, that Suidas confused γαλῆ with γαλεός and that some early scholars of the modern period made the mistake of identifying the γαλῆ as a type of dogfish.

The first certain occurrence of γαλῆ is a bare mention by Epaenetus,[29] who was active about 100 B.C. Aelian,[30] who clearly distinguishes the γαλῆ from the γαλεός, says that the γαλῆ is much like the ἤπατος,[31] for it is a small fish with dull eyes, the pupils approximately dark blue. Its barbel is larger than that of the ἤπατος, he says, and smaller than that of the χρέμψης; it feeds on seaweed and is a rockfish, and like the land γαλῆ (the weasel) allegedly eats the eyes of corpses it encounters. He gives Epirus as its habitat. There is no other ascertainable occurrence of the word as a fish name in the classical period. It is noteworthy that except for the single conjectural occurrence of the word in Aristotle it is not met in the literature until about 100 B.C. This circumstance suggests that it is possible that γαλῆ is a mere translation of *mustela*, which was in use at least as early as the second century B.C. and was a much more common name.

Aelian's account points to the burbot, *Lota vulgaris* Cuvier, although H. Gossen[32] maintains that it is an accurate description of the 3-bearded rockling, *Motella tricirrata* Nilsson, which is said to be good eating, although it is now little used

[16] Cf. Francis Day, *The fishes of Great Britain and Ireland* **1**: 308. 1880–84. Note *Hor. Sat.* 2.8.29.

[17] Cf. *La pesca nei mari* **3**: 70, 39, 103.

[18] Cf. Paul Barbier, "Noms de poissons, notes étymologiques et lexicographiques," Rev. Langues Romanes **56**: 181. 1913.

[19] Cf. W. Meyer-Lübke, *Romanisches etymologisches Wörterbuch*, ed. 3: 416. (Heidelberg, 1935.)

[20] *Mos.* 106 ff.

[21] It has been so identified by L. Tross, E. Böcking, and Schäfer.

[22] E.g., Gesner, Salviani, Paulus Jovius, and Francis Day.

[23] Thompson (*op. cit.*: 169) feels sure that Ausonius' account applies to the sturgeon.

[24] 8.17.8: *avidae mustelae.*

[25] *Op. cit.*: 168.

[26] *Hist. an.* 508 b 17.

[27] Cf. D'Arcy W. Thompson, *The Works of Aristotle translated into English* **4**: *Historia animalium* (Oxford, 1910), note on *loc. cit.*

[28] Cf. H. A. Hoffman and D. S. Jordan, "A Catalogue of the Fishes of Greece," Proc. Acad. Nat. Sci. Philadelphia 1892: 234.

[29] Apud Athen. 7.328.f.

[30] *Nat. an.* 15.11; cf. Plin. *N.H.* 32.53.

[31] Despite Steier, Aelian does not give ἤπατος as a synonym of γαλῆ but merely says that the γαλῆ resembles the ἤπατος. Steier is incorrect in his interpretation of Aelian's passage and overly hasty in accepting the inference of Alfred Papendick (*Die Fischnamen im griechisch-lateinischen Glossaren*: 34. Königsberg, 1926) from the equation of *mustela* with ἤπατος in *CGL* **3**: 89, 16 that γαλῆ, *mustela*, and ἤπατος are all equivalent. On the other hand, the synonymy of *mustela* and γαλῆ is attested by many lemmas in *CGL*, viz., **2**: 131, 59; 261, 16; **3**: 18, 57; 90, 69; 189, 43; 256, 65; 259, 35; 361, 70; 471, 17, as well as the form γαλέα, viz., **3**: 132, 50; 187, 16; 320, 39; 431, 46; 495, 57; 512, 61.

[32] "Die Tiernamen in Ælians 17 Büchern περὶ ζῴων," Quellen und Studien Geschichte Naturw. und Medizin **4** (3) (hereafter cited as "Aelian"), par. 140. 1935; "Zoologisches bei Athenaios," *idem* **7** (2/3) (hereafter cited as "Athen."): 262. 1939.

except by the poor, since its odor a few hours after death becomes distinctly unpleasant.[33] This weakens the identification of Gossen, who incidentally fails to explain the presence of a marine species in Epirus. It is noteworthy that γάλια is the regular Modern Greek name for the burbot[34] and that this species has been known as galea in Liguria and at the northern end of the Adriatic,[35] a name which goes back to a Greek form γαλέη.[36] It should be remarked, however, that the lamprey is called γαλεή and γαλειᾶ in Modern Greek.[37]

Hesychius of Alexandria gives γάλοι as a synonym of γάδος, and Hesychius and the Lexicon of Cyrillus give γάλα as a synonym of γάδος. On the first equation Schweighäuser[38] comments that perhaps γάλοι is a corruption of γαλία, and on the second he remarks that possibly γάλα is for γαλᾶ, which would be a contraction of γαλέα. Gossen[39] emends the γάλα of Hesychius' second equation to γαλαρίας, identifying the fish as the poor-cod, *Gadus minutus* Linnaeus. This is of no value as a food fish,[40] although it is fairly common in the Mediterranean.[41] If the names which appear in Hesychius and the Lexicon of Cyrillus are actually corruptions of γαλῆ or variants of that name, γαλῆ must have been used, at least in the late period, as a synonym of γάδος, which is discussed later in this article.

Hesychius also defines γαλίαι as ὀνίσκοι, similarly identified by Gossen[42] as the poor-cod. The ὀνίσκος is discussed below.

Since the earliest certain occurrence of γαλῆ is comparatively late, since the term is found only in two technical writers of the classical period, if we exclude Aristotle, and since it survives to only a limited extent in the modern nomenclature, it is a logical inference that the term was probably not in popular use, but was merely a translation of *mustela*, as has already been suggested. We have already seen that in Aelian its use as a term for the burbot parallels one common application of *mustela*, but the application of *mustela* to the burbot almost certainly represents an extension from its marine relatives. It is therefore perhaps not pressing the meagre evidence too hard to assume that in Greek technical writers γαλῆ was used as a term for *Phycis* sp. and *Motella* sp.

3. Ἥπατος

It was pointed out above that Aelian says that the ἥπατος is very similar to the γαλῆ, which he describes as a small fish with dull eyes, the pupils approximately dark blue, with a barbel larger than that of the ἥπατος. Elsewhere[43] he describes the ἥπατος as a large, but sluggish, fish that lurks in hiding places of the sea. Aristotle describes the ἥπατος as a fish with few caeca,[44] solitary, carnivorous, with serrate teeth, black in color, with large eyes and a triangular, white heart.[45] Speusippus[46] says that it resembles the φάγρος (the braize, *Pagrus vulgaris* Cuvier and Valenciennes) and the ἐρυθρῖνος (possibly the Mediterranean barbier, *Serranus anthias* Cuvier and Valenciennes). Eubulus [47] says that it has no gall. Diocles[48] refers to it as a rockfish. Hegesander [49] states that it has two stones in its head, similar in luster and color to those found in oysters, but rhomboid in shape. Such ear stones might be found in any bony fish, but not in the shark family. Phylotimus[50] classifies the ἥπατος as a fish with soft flesh. Galen[51] says that it has flesh of intermedate consistency, despite Phylotimus. Oribasius[52] also calls it a fish with flesh of intermediate consistency, and Xenocrates says that the flesh is moderately delicate and of relatively loose texture,[53] and should not be eaten in the fall, for then it is of bad juice.[54] Marcus Sidonius[55] speaks of it as

[33] Cf. Day, *op. cit.* (see note 16), **1**: 317.
[34] Cf. Thompson's note on Aristot. *Hist. an.* 508 b 17 and Hoffman-Jordan, *loc. cit.* (see note 28).
[35] Cf. P. Rolla, *Ittiologia populare*: 21. Casale, 1906.
[36] Cf. Gerhard Rohlfs, *Etymologisches Wörterbuch der unteritalienischen Gräzität*, no. 407. Halle, 1930.
[37] Cf. Thompson, *Glossary*: 168.
[38] Note on Athen. 7.315.f.
[39] "Die zoologischen Glossen im Lexikon des Hesych," Quellen und Studien Gesch. Naturw. und Medizin **7** (1) (hereafter cited as "Hesych."): nos. 338 and 341. 1937.
[40] Cf. Day, *op. cit.* (see note 16) **1**: 288.
[41] Cf. Carus, *op. cit.* (see note 5) **2**: 571.
[42] "Hesych." (see note 39), no. 345.
[43] *Nat. an.* 9.38. Thompson (*op. cit.*: 76) regards this as a different fish from the usual ἥπατος.
[44] *Hist. an.* 508 b 19.
[45] Page 306 Rose (apud Athen. 7.301.c).
[46] Apud Athen. 7.300.e.
[47] *Ibid.* 3.108.a (in Kock, *Comicorum Atticorum fragmenta* **2**: 185).
[48] *Ibid.* 7.301.c (p. 173, Wellmann).
[49] *Ibid.* 3.108.a (in Müller, *Fragmenta historicorum graecorum* **4**: 420).
[50] Apud Galen. *Alim. fac.* 3.29 (p. 368.1 Helmreich).
[51] *Alim. fac.* 3.29 (p. 370.15 Helmreich).
[52] *Coll. med.* 3.15.7.
[53] *Alim. aquat.* 10 (exc. Oribas. *Coll. med.* 2.58.-27).
[54] *Ibid.* 3.
[55] 10.

crooked-toothed. It is apparently this fish which Pliny[56] calls hepar.

J. P. J. M. Brands[57] explains this name as a derivative of ἧπαρ, "liver," meaning literally "liverish," which seems correct, and says that the fish is unidentifiable. F. A. Wood[58] conjectured that the fish was so named because it was liver-colored. Reinhold Strömberg[59] accepts this as one possibility, calling attention (as does Wood) to ἡπατίζειν, "to be liver-colored," and ἡπατῖτις, "liver-colored," but also points out that it may have been so named because it had a large liver. He suggests that the statement of Eubulus that the fish had no gall may represent only an inference from the name. But D'Arcy W. Thompson[60] suspects that the source of ἧπατος is Egyptian abtu, a word for a fish occurring in the Book of the Dead. He considers the fish unidentified, stating that it was supposed by Belon and by Cuvier, on no valid grounds, to be the haddock or some similar gadoid fish. More specifically, Cuvier[61] identified the ἧπατος as the eglefin, *Gadus aeglefinus* Linnaeus, which does not occur in the Mediterranean.[62] Gossen[63] on the basis of Aristotle's description identifies the fish as *Molva elongata* Risso, a type of ling belonging to the gadoid family and found in the Mediterranean.

4. Λεβίας

Aristotle's description of the ἧπατος[64] is quoted by Athenaeus,[65] who gives λεβίας as a synonym of ἧπατος and cites Diocles as classifying the λεβίας as a rockfish and Speusippus as comparing it to the φάγρος (the braize). Hesychius defines λεβίας as a type of preserved fish with the scales left on, also used as a term for a type of lake fish. Aristophanes[66] lists the λεβίας along with the σκόμβρος (the common mackerel, *Scomber scomber* Linnaeus), the κολίας (the coly mackerel, *Scomber colias* Gmelin), the σαπέρδη (a type of scienid), the μύλλος (a type of scienid), and the θύννις (the common tunny, *Thynnus vulgaris* Cuvier and Valenciennes). Pollux[67] lists the same six fishes. Diphilus[68] compares the λεβίας to the σίλουρος (probably here the sheatfish, *Silurus glanis* Linnaeus) and says that both were popular among the Rhodians. Archestratus[69] speaks of buying both the λεβίας and the ἧπατος at Delos and Tenos.

Gossen[70] regards λεβίας as a mere synonym of ἧπατος and similarly identifies it as *Molva elongata*. Thompson[71] identifies the λεβίας as *Labeo niloticus* Cuvier. This may be correct in so far as the name refers to a Nile fish, but as a term for a marine fish of the Mediterranean it must have denoted a different species. In the latter sense it was identical with or very similar to the ἧπατος, and both were very much like the γαλῆ, which is almost certainly a gadoid. It is very probable, therefore, that both of these names were used as terms for one or more of the gadoids, although there is no ascertainable survival of either name in the modern nomenclature.

5. Δελκανός

Euthydemus[72] says that a fish known as the δελκανός was named after the river Delcos, where it was caught, and was very wholesome pickled in brine. Hesychius defines Delcos as a marsh in Thrace that was rich in fish. Dorion[73] says that this δελκανός was identified by some with the λεβίας. Hesychius defines λεβίας as sometimes meaning a lake fish.

Gossen[74] identifies this fresh-water δελκανός as *Barbus plebeius* Valenciennes, a small barbel which occurs in both the Italian and the Balkan lakes and rivers. It has already been pointed out that mustela certainly and γαλῆ probably were applied not only to certain marine gadoids, but also the the fresh-water burbot, *Lota vulgaris* Cuvier. It seems very likely that both the δελκανός and the lake λεβίας were also the burbot.

[56] *N.H.* 32.149.
[57] *Grieksche Diernamen*: 156. Purmerend, 1935.
[58] "Greek Fish Names," Amer. Journ. Philol. **49**: 49. 1928.
[59] "Studien zur Etymologie und Bildung der griechischen Fischnamen," Göteborgs Högskolas Årsskr. **49**: 45. 1943.
[60] *Op. cit.*: 76.
[61] Cuvier et Valenciennes, *Histoire naturelle des poissons* **2**: 232. Paris, 1828–49.
[62] Cf. Day, *op. cit.* (see note 16) **1**: 283.
[63] "Aelian" (see note 32), par. 140; "Athen." (see note 32): 261.
[64] Page 306 Rose.
[65] 7.301.c.
[66] Apud Athen. 3.118.c (in Kock, *Comicorum Atticorum fragmenta* **1**: 499).
[67] 6.48.
[68] Apud Athen. 4.132.d (in Kock, *op. cit.* **2**: 545).
[69] *Ib.* 7.301.d (frg. 30 Ribbeck; frg. 27 Brandt).
[70] "Athen." (see note 32): 261.
[71] *Op. cit.*: 9, 146; cf. "On Egyptian Fish Names Used by Greek Writers," Journ. Egyptian Archaeol. **14**: 23–24. 1928.
[72] Apud Athen. 3.118.b.
[73] *Ibid.*
[74] "Hesych." (see note 39), nos. 427 and 1259; "Athen." (see note 32): 240.

6. Πρέπων

Oppian[75] speaks briefly of the πρέπών as a fish which lurks in lairs in the depths of the sea and, being large and powerful in body, but somewhat sluggish in movement, lies in wait for smaller fish. Aelian[76] describes the fish in almost identical terms. Suidas says that πρέπων and πρόβατον were alternative terms for a very large fish known as ὕπατος. The fish is also mentioned by Marcus Sidonius.[77] The description of the fish, the fact that Suidas identifies it with the ὕπατος (properly ἧπατος?), and the fact that Aelian describes the ἧπατος in almost identical language in the same passage suggest that this is one of the Gadidae.[78]

7. Πρόβατον

The πρόβατον, or "sheepfish," is described in precisely the same terms as the πρέπων by both Oppian[79] and Aelian,[80] except that the former[81] also says that when hooked it often escaped by merely becoming a dead weight on the line, sinking to the bottom. Although Suidas regarded πρέπων and πρόβατον as synonymous, both Oppian and Aelian clearly considered them different fish. Rondelet reported that the umbra (one of the scienids) was called "sea-sheep" by the Greeks in his day. Belon thought that the fish might be *Merlangus poutassou*. Mair[82] identifies it merely as one of the Gadidae. Gossen[83] calls it specifically *Merluccius vulgaris* Fleming. Thompson[84] regards it as unidentified.

8. Ὄνος

Ancient sources yield much more information regarding the ὄνος or "assfish." Aristotle[85] says that some fishes hide in the sand and some in the mud, but the majority hide only during the winter, crustaceans, rockfishes, rays, and cartilaginous fishes hiding only during extremely severe weather, as is evident from the fact that they are not caught when the weather is extremely cold. But some fishes hide in summer, for example, the γλαῦκος (unidentified), which hides in summer for about 60 days. The ὄνος and the χρύσοφρυς (the gilt-head, *Chrysophrys aurata* Cuvier and Valenciennes) also hide in summer, and that the ὄνος hides for a long period may be inferred from the fact that there is a long period when it is not caught. Oppian[86] also comments on the fact that the ὄνος stays in hiding during the heat of summer. Aristotle also says[87] that the ὄνος, the βάτος (the skate, *Raja* sp.), the ψῆττα (the plaice, *Pleuronectes* sp.), and the ῥίνη (the angel-shark, *Rhina squatina* Rafinesque) burrow in the sand, and after concealing themselves angle with the filaments that they have in their mouths, which fishermen call their fishing rods. In Pliny's rendering of this passage[88] there is no reference to the ὄνος. Athenaeus[89] quotes Aristotle as saying that the ὄνος, like sharks and dogfishes (γαλεοί), has a widely gaping mouth and is not gregarious. It is the only fish that has its heart in its stomach,[90] and in its brain it has stones resembling millstones. It is also the only fish that lives in holes during the hottest dogdays, all the others going into hiding during the severest winter weather. Aristotle[91] in a dubious passage says that it angles like the βάτραχος (the fishing frog, *Lophius piscatorius* Linnaeus). Epicharmus[92] refers to the stomach of the ὄνος as extraordinary.[93] Aelian[94] also says that the ὄνος is not gregarious and is the only fish that has its heart in its stomach and has stones in its head resembling millstones, being also the only fish to go into hiding in the dogdays, all the others hiding only in the severest winter weather. Oppian speaks

[75] *Hal.* 1.146 ff.
[76] *Nat. an.* 9.38.
[77] 8.
[78] Cf. Mair, note on Oppian. *loc. cit.* Gossen ("Aelian" [see note 32], par. 140) says that it is probably the coalfish, *Gadus virens* Linnaeus, which is rare in the Mediterranean. Thompson (*op. cit.*, p. 218) states only that it is an unknown, large, deep-sea fish. Strömberg (*op. cit.* [see note 59]: 33) regards πρέπων as a present participle of πρέπω, "shine forth," hence "excellent," "that which is suitable (for eating)," and infers from Aelian that the term belonged to the fishermen's patois.
[79] *Loc. cit.*
[80] *Loc. cit.*
[81] *Hal.* 3.139 ff.
[82] *Loc. cit.*
[83] *Loc. cit.*
[84] *Op. cit.*: 220.
[85] *Hist. an.* 599 b 26 ff.
[86] *Hal.* 1.151 ff.
[87] *Hist. an.* 620 b 29 ff.
[88] *N.H.* 9.144.
[89] 7.315.e (p. 311 Rose).
[90] Cf. Aelian. *Nat. an.* 5.20.
[91] *Hist. an.* 620 b 30.
[92] Apud Athen. 7.315.f (in Kaibel, *Comicorum graecorum fragmenta*: 102).
[93] Thompson (*op. cit.*: 183) comments that the "paunch" is not especially large, the saying arising perhaps from the fact that the large swim bladder is apt to force the stomach out of the mouth when hake or cod are pulled up from deep water.
[94] *Nat. an.* 6.30.

of the *ὄνος* as a very large fish that sinks to the bottom when hooked, instead of fighting, and by sheer weight often breaks the line and gets free,[95] and gives the deep sea as its habitat.[96] Phylotimus[97] lists the *ὄνος* among the soft-fleshed fishes.

This is all the useful information regarding the *ὄνος* obtainable from ancient sources, and most of it clearly stems from Aristotle. The modern nomenclature is not helpful, for *ὄνος* has been largely replaced by names based on *γάδος*. Bussemaker and Cresswell identified the *ὄνος* as the cod, *Gadus mustela* Linnaeus; Cuvier and Littré, as the 3-bearded rockling, *Motella tricirrata* Nilsson; and C. D. Badham[98] thought that it might be the sea-tench or Mediterranean hake, *Phycis mediterraneus* De la Roche, which he says has a barbel and a large head and is the only gadoid with barbels frequenting southern seas. Camus[99] identified it as the eglefin, *Gadus aeglefinus* Linnaeus, which does not occur in the Mediterranean.[100] Gossen [101] identifies it as the bib or pout, *Gadus luscus* Linnaeus, which is only a wanderer in the Mediterranean, stragglers being taken as far to the east as Italy, but almost never as far as Greece.[102] Brands[103] goes no farther than to say that it is one of the Gadidae. The *ὄνος* has generally been identified as the common hake, *Merluccius vulgaris* Cuvier,[104] which occurs in the Mediterranean, especially along the northern shores, and in the Adriatic, and has coarse flesh that may be cut into steaks and fried or cooked in pies.[105] If the text of Aristotle is correct, it should be referred rather to the Mediterranean hake, *Phycis mediterraneus* De la Roche, and the fork-beard hake, *Phycis blennioides* Bloch and Schneider,[106] both of which are common in the Mediterranean.[107]

9. Ὀνίσκος

With regard to the *ὀνίσκος*, the chief problem is whether or not it is identical with the *ὄνος*, of which this is a diminutive form. Oppian, to judge from the data he gives, considered them different fishes; and Dorion[108] definitely differentiates the two; but Galen[109] says that what Phylotimus called *ὄνος* others called *ὀνίσκος*; and Eustathius[110] and Hesychius give *ὀνίσκος* as a synonym of *ὄνος*. The *ὀνίσκος* was certainly closely related to the *ὄνος*, if it was not identical with it. It was a white fish[111] that lived in the sea,[112] feeding in the mud and the shallows.[113] It was not a rockfish, although its flesh was of equal firmness, according to Galen.[114] On the other hand, Xenocrates[115] speaks of the flesh as of intermediate consistency, and Oribasius[116] refers to it as soft, but not particularly friable, and devoid of excrementitious humors. Xenocrates also states[117] that the flesh is not acrid, is of good juice, difficult to assimilate, easy to pass, and nourishing. Since it was used as bait for the tunny,[118] the *ὀνίσκος* could not have been a very large fish. Oribasius[119] mentions a freshwater type. The marine type was considered unsuitable for salting.[120]

Barbier[121] identifies the *ὀνίσκος* with the *ὄνος* and refers it likewise to the common hake, *Merluccius vulgaris* Cuvier. Bussemaker distinguished it from the *ὄνος* and identified it as the common whiting, *Gadus merlangus* Linnaeus (*Merlangus vulgaris* Fleming). Thompson[122] believes that the *ὀνίσκος* is probably one of the lesser species of the cod family, perhaps the poutassou, *Merlangus poutassou* Risso, the 3-

[95] *Hal.* 3.138 ff.
[96] *Ibid.* 1.151.
[97] Apud Galen. *Alim. fac.* 3.29 (p. 368.1 Helmreich).
[98] *Prose halieutics, or ancient and modern fish tattle*: 353. London, 1854.
[99] *Histoire des animaux d'Aristote, avec la traduction française* **2**: 84. Paris, 1783.
[100] Cf. Day, *op. cit.* (see note 16) **1**: 283.
[101] "Hesych." (see note 39), nos. 338 and 1557; "Aelian" (see note 32), par. 140; "Athen." (see note 32): 261.
[102] Cf. Day, *op. cit.* (see note 16) **1**: 286; Carus, *op. cit.* (see note 5) **2**: 572.
[103] *Op. cit.*: 171.
[104] Cf. Mair's ed. of Oppian, introd.: lxv; Paul Barbier, "Noms de poissons," Rev. Langues Romanes **53**: 27. 1910.
[105] Cf. Day, *op. cit.* (see note 16) **1**: 300.
[106] Cf. Thompson, note on Aristot. *Hist. an.* 599 b 34; *Glossary:* 182; Mair, *loc. cit.*
[107] Cf. Day, *op. cit.* (see note 16) **1**: 303; Carus, *op. cit.* (see note 5) **2**: 575.
[108] Apud Athen. 7.315.f.
[109] *Alim. fac.* 3.29 (p. 368.21 Helmreich).
[110] Page 862.
[111] Marc. Sid. 11.
[112] Galen. *Alim. fac.* 3.40 (p. 384.18 Helmreich); *De bon. mal. suc.* 3 (p. 397.1 Helmreich).
[113] Oppian. *Hal.* 1.105.
[114] *De bon. mal. suc.* 9 (p. 417.24 Helmreich).
[115] *Alim. aquat.* 1.
[116] *Coll. med.* 3.2.11; 4.1.37.
[117] *Alim. aquat.* 14.
[118] Oppian. *Hal.* 3.191.
[119] *Coll. med.* 3.15.5.
[120] Galen. *Alim. fac.* 3.40 (p. 384.18 Helmreich); Oribas. *Coll. med.* 4.1.37.
[121] *Loc. cit.* (see note 104).
[122] *Glossary*: 181–182.

bearded rockling, *Motella tricirrata* Nilsson, or the poor-cod, *Gadus minutus* Linnaeus. The common whiting has been much esteemed as a food fish, more so perhaps than any other species of the genus, being very easy to digest except in April, May, and June, when it is out of condition and may cause nausea and even vomiting. It is best eaten immediately after capture, since it decomposes rapidly. When the takes exceed the demand, whitings are often salted or dried.[123] Since the marine ὀνίσκος was not suited for salting, it is probably not the common whiting. Another significant point casting doubt on the common whiting is that such physicians as Galen, Xenocrates, and Oribasius would almost certainly have commented on the dangers of eating it out of season. In addition, the common whiting is rare in the Mediterranean,[124] and it is clear that the ὀνίσκος was very common. Gossen regards the equation of ὄνος with ὀνίσκος as an outright error[125] and like Thompson suggests that the ὀνίσκος may be the poor-cod.[126] But this is a very dubious identification, since the poor-cod is practically worthless as a food fish,[127] and Xenocrates comments favorably on the dietetic qualities of the ὀνίσκος. If the ὀνίσκος was not identical with the ὄνος, it was certainly very similar to it, and identification of this fish as the common hake is therefore very plausible.

10. Ὀνίας

Brands[128] cites ὀνίας as a fish name used by Dorion[129] and Oppian,[130] identifying it as one of the Gadidae. Actually, in the cited passages Dorion uses ὄνος and Oppian ὀνίσκος, and if Brands had delved a little deeper, he would not so readily have acknowledged himself unable to explain the extension of ὄνος, "ass," to a fish. Nicander of Thyateira[131] says that there are two kinds of σκάρος, one of which is the ὀνίας and the other the αἴολος. Hesychius also defines ὀνίας as a type of σκάρος. The σκάρος, as has already been pointed out, is the parrotfish, *Scarus cretensis* Cuvier and Valenciennes. Αἴολος is not a fish name, but a descriptive epithet, probably alluding to the shimmering gleam of the scales of a freshly caught fish[132]; and it was applied to varied fishes, such as the πέρκη (the sea-perch, *Serranus scriba* Cuvier and Valenciennes),[133] the μόρμυρος (one of the sea-breams, probably *Pagellus mormyrus* Cuvier and Valenciennes),[134] the σάλπη (the saupe, *Box salpa* Cuvier and Valenciennes),[135] and the κορακῖνος (one of the scienids, probably *Corvina nigra* Cuvier and Valenciennes).[136] Clearly, therefore, ὀνίας was a descriptive epithet, alluding in the case of the σκάρος to a dull, ass-gray type; and ὄνος and ὀνίσκος were applied to certain gadoids because of their ass-gray coloration.[137] Identification of the ὀνίας of Nicander as perhaps *Smaris vulgaris* in the *Greek-English lexicon* of Liddell-Scott-Jones assuredly has slight justification.

11. Καλλαρίας

Another Greek fish name which apparently belongs in the gadoid group is notable for the variety of forms in which it occurs. Oppian[138] uses the form καλλαρίας and differentiates this fish from the ὀνίσκος, mentioning that it also frequents muddy shallows. Archestratus[139] identifies the καλλαρίας with the ὄνος. Dorion speaks of the γαλλαρίας as a type of ὀνίσκος with one spiny fin, like the river μύραινα,[140]

[123] Cf. Day, *op. cit.* (see note 16) **1**: 290.
[124] Cf. Carus, *op. cit.* (see note 5) **2**: 571.
[125] "Hesych." (see note 39), no. 1557.
[126] *Loc. cit.* and no. 213.
[127] Cf. Day, *op. cit.* (see note 16) **1**: 288.
[128] *Op. cit.* (see note 57), p. 171.
[129] Apud Athen. 7.315.f.
[130] *Hal.* 3.191.
[131] Apud Athen. 7.320.c.

[132] Cf. Léon Lacroix, "Notes critiques à Athénée, Épithètes et noms de poissons dans un vers de Numenius (Athen. 7.326.a)," Mélanges Desrousseaux: 256, note 2. Paris, 1937. Strömberg (*op. cit.* [see note 59]: 23) thinks that the word also alluded to the quick and lively movement of those fishes to which it was applied, but this is not consistent with the actual applications.
[133] Epicharm. frg. 47.48 Kaibel (*Comicorum graecorum fragmenta*).
[134] Oppian. *Hal.* 1.100.
[135] *Ib.* 1.125.
[136] Numen. apud Athen. 7.308.e.
[137] Strömberg (*op. cit.* [see note 59]: 100), accepting the gray coloration as the basic reason for the application of these names, points out that a fish with a large head would be regarded as stupid and obstinate and might therefore be called "assfish."
[138] *Hal.* 1.105.
[139] Apud Athen. 7.316.a (frg. 35 Ribbeck, frg. 14 Brandt).
[140] *Ibid.* 7.312.d Μύραινα generally denoted the moray, *Muraena helena* Linnaeus, while the European fresh-water eel, *Anguilla vulgaris* Turton, was known as ἔγχελυς, and the conger eel, *Conger vulgaris* Cuvier, as γόγγρος. There is no fresh-water type of moray, and Dorion's river μύραινα must therefore be a different fish. There is, moreover, in the region known to Dorion, no fresh-water fish similar to the moray with one spiny fin, and he was familiar with the use of ἔγχελυς as a term for the fresh-water eel. By elimination, accordingly, Dorion may have had in mind the burbot, *Lota vulgaris* Cuvier, or the lamper eel, *Petro-*

says that the γαλλερίας[141] was also called ὀνίσκος,[142] and gives both χελλαρίης and ὀνίσκος as synonyms for μύλλος (usually a type of scienid).[143] Euthydemus[144] identifies the γελαρίης[145] with the ὀνίσκος and the βάκχος. Hesychius identifies the γαλαρίας with the ὀνίσκος. He also gives χελιδών and χελιδονίας as synonyms of χελεάρ and says that χελεάρ also denoted a kind of fish.

Strömberg[146] thinks that the form χελλαρίης may have arisen through folk etymology by a crossing of καλλαρίης with χελ(λ)ών, "gray mullet." In the case of forms beginning with γαλ- he suspects the influence of the generic term γαλεός (shark or dogfish). He suggests that γαλλερίας arose from γαλεός by the influence of ἀστερίας (perhaps the smooth dogfish, *Mustelus vulgaris* Müller). Neither explanation is especially convincing, for Strömberg starts from the dubious hypothesis that γαλεός and γαλῆ are really variants of the same word and that therefore people were inclined to associate sharks and dogfishes with the gadoids. Gossen[147] calls χελεάρ a Laconian word which is either equivalent to χελιδονίας and in that case possibly denotes *Luvarus imperialis* Rafinesque,[148] or is equivalent to χελλαρίας and in that case is synonymous with ὀνίσκος and denotes the poor-cod, *Gadus minutus* Linnaeus. Thompson[149] is also inclined to read χελλαρίης for χελεάρ, making it synonymous with ὀνίσκος. Hesychius also gives γάλα and ὄξος as synonyms of γάλος, and Gossen[150] here emends to γαλαρίας and ὄνος. In still another definition Hesychius gives καλαρίας as a synonym of λαζίνης. Pliny[151] classifies the collyri (emended by some to callariae) as a smaller type of asellus. Since he identifies the bacchus as a type of asellus caught only in deep water and therefore preferred to the collyrus, the collyrus obviously must have been caught in shallow water. Collyrus is certainly a transliteration of some Greek name for one of the gadoids, possibly *κολλυρίας, a conjectural variant of the name here discussed.

Since there are almost no descriptive clues, identification in this case must depend almost solely upon the equations made in ancient sources, and these are not entirely in harmony. They do indicate that the name must have denoted a fish very similar to or identical with the ὄνος or the ὀνίσκος, which would make it a type of cod or hake. As mentioned above, Gossen believes that χελεάρ if equivalent to χελλαρίας is a synonym of ὀνίσκος and denotes the poor-cod, *Gadus minutus* Linnaeus. He also so identifies the γαλαρίας.[152] Other scholars have similarly identified this fish name.[153] But when the name is used as a synonym of γάδος, or as a synonym of λαζίνης, also called χαραδρίας, Gossen refers it to *Gadus luscus* Linnaeus[154]. Brands[155] says that the name is not identifiable. Neither *Gadus luscus* nor *Gadus minutus* is a very plausible identification. As has already been pointed out, the latter is practically worthless as a food fish, and the former is only a wanderer in the Mediterranean, almost never being caught as far to the east as Greece. It is difficult to see how it is possible to restrict the meaning any further than to say that this fish is apparently a type of cod or hake, although Thompson[156] thinks that it is probably the common hake, *Merluccius vulgaris* Cuvier.

myzon fluviatilis Linnaeus. Of these two, the latter is a somewhat more plausible identification, first because there are some Greek fish names, presumably known to Dorion, which apparently were applied to the burbot, whereas no Greek fish name can with assurance be referred to the lamper eel, and second because there was a marked tendency to confuse the lamper eel with the moray (cf. Thompson, *op. cit.*: 164). Gossen ("Athen." [see note 32]: 246) says that Dorion's μύραινα is certainly the Kurzschwanzaale (by which he apparently means the suborder Symbranchii) and asserts that the scholarly Dorion is the only one to report that it has only one bone (Gräte). This supposition borders on fantasy. The Symbranchii do not resemble the moray, but the eel, and they do not occur in streams emptying into the Mediterranean. Moreover, the ἄκανθα to which Dorion alludes is almost certainly a prominent fin ray, not a bone. As for the γαλλαρίας with one spiny fin, it may be noted that *Motella* sp. has two dorsal fins, the anterior of which is reduced to a narrow, rayed fringe, more or less concealed in the longitudinal groove, and the first ray of this anterior fin is prolonged.

[141] Sic Meineke; γαλλερίδας AC.
[142] Apud Athen. 7.315.f.
[143] *Ibid.* 3.118.c.
[144] *Ib.* 7.315.f.
[145] Sic A; γαλλερίης C.
[146] *Op. cit.* (see note 59): 130.
[147] "Hesych." (see note 39), no. 2296.
[148] The χελιδονίας, or "swallowfish," of the Greeks is probably the flying gurnard, *Dactylopterus volitans* Cuvier and Valenciennes.
[149] *Op. cit.*: 285.
[150] "Hesych." (see note 39), no. 338.
[151] *N.H.* 9.61 and 32.146.
[152] "Hesych." (see note 39), nos. 338 and 1236.
[153] Cf., e.g., Külb in August Steier, *Aristoteles und Plinius zur Geschichte der Zoologie*: 82. Würzburg, 1913.
[154] *Op. cit.* (see note 57): 159.
[155] *Op. cit.*: 97.
[156] *Op. cit.*: 285.

12. Λαζίνης

So far as can be ascertained, the only occurrence of λαζίνης as a fish name is in Hesychius, who says that it denoted the χαραδρίας and the fish καλαρίας.[157] As a fish name, λαζίνης probably represents an extension from a type of plover.[158] It may be a gadoid.

13. Ὄξος

Likewise, the ὄξος which Hesychius gives as a synonym of γάδος is apparently the only occurrence of this word as a fish name, and Gossen's emendation to ὄνος is therefore plausible, more especially since there is no logical explanation for the application of this word to a fish.

14. Galaxias

There is another fish name which bears a close resemblance to καλλαρίας and its variants. Phylotimus[159] lists the γαλεώνυμος among fishes with hard flesh. Oribasius[160] says that this fish is of bad juice and difficult to digest. Galen[161] says that there is more than a single kind of γαλεός, and that one type, which brought a very high market price among the Romans, was called γαλαξίας[162] by them, but either γαλεός or γαλεώνυμος by the Greeks. He aiso says that it was a fish with soft flesh, although the other γαλεοί had hard flesh, and that Phylotimus probably fell into error on this point because the fish apparently did not occur in the Greek sea and he was therefore not personally acquainted with it.

Strömberg[163] says that the form γαλεώνυμος almost certainly arose by a blending of γαλεός and καλιώνυμος (*sic*). The latter, he says, is the name of a fish of prey that was called λύκος and properly means "with a beautiful name," being a typical example of the application of a flattering name to a ferocious fish for the purpose of winning its goodwill. But καλλιώνυμος apparently was not the name of a fish of prey, but of the scabbardfish, *Uranoscopus scaber* Linnaeus, which was ironically called by this name because it was so ugly. Its byname, moreover, was not λύκος, "wolf," but λύχνος, "lamp," possibly applied to it because it was active at night. With regard to γαλαξίας, Strömberg, who takes this to be a Greek term, despite the explicit statement of Galen, suggests that it is perhaps a corrupt derivative of γαλεός, influenced by a word in -αξιας, such as ταραξίας. This hypothesis has little to recommend it.

The account of Galen suggests a type of shark or dogfish, but no shark or dogfish is known to have been present in Italian but not in Greek waters. A second possibility is that it may have been a type of sturgeon. On the other hand, it is barely possible that Galen, even though he was personally acquainted with the fish, thought that its Greek name was γαλεός, whereas it was actually γαλῆ, a name which does not occur in his extant works. As has been mentioned before, others lapsed into error on the same point. In that event, the galaxias is probably a gadoid. Furthermore, if galaxias is synonymous with γαλῆ, it is also synonymous with mustela, which would make it a term for *Phycis* sp. and *Motella* sp. Pliny ranked the mustela second only to the parrotfish in his time, and Galen comments on the unusually high market price of the galaxias.

15. Βάκχος

Still another Greek fish name which belongs in this group is βάκχος. Euthydemus[164] makes it synonymous with γελαρίης and ὀνίσκος. Eustathius[165] gives it as a synonym of ὄνος and ὀνίσκος. Xenocrates[166] classifies it as a fish with flesh of intermediate consistency, and Diphilus of Siphnos[167] considered it of good and abundant juice and nourishing. Pliny[168] classifies the bacchus as a type of asellus caught only in the deep sea and therefore preferred to the collyri. The difficulties in this case are aggravated by the fact that βάκχος not only must have denoted a type of gadoid but was used as an alternative term for the μύλλος (usually one of the scienids), like χελλαρίης and ὀνίσκος,[169] and also denoted a type of gray mullet, possibly *Mugil saliens*

[157] Thompson (*op. cit.*: 144) would read καλλαρίας for καλαρίας and χελλαρίας for χαραδρίας. Coray emended λαζίνης to μάζωνος, discussed subsequently in my text.
[158] Cf. Brands, *loc. cit.*
[159] Apud Galen. *Alim. fac.* 3.30.1 (p. 372.5 Helmreich).
[160] *Coll. med.* 3.16.9 and 3.18.9.
[161] *Alim. fac.* 3.31 (p. 372.18 Helmreich).
[162] γαλαξίας AB; γαλεξίας V. Note *CGL* 3: 241, 37: δ γαλαξίας galaxias.
[163] *Op. cit.* (see note 59): 108–109.
[164] Apud Athen. 7.315.f.
[165] Page 862.
[166] *Alim. aquat.* 1.
[167] Apud Athen. 7.356.b.
[168] *N.H.* 9.61 and 32.145.
[169] Cf. Dorion apud Athen. 3.118.c.

Risso.[170] The name clearly was applied to several different fishes, and identification of the gadoid to which it was sometimes applied would be simpler if the common characteristic responsible for the application of this name to such different fishes were known. The most attractive guess is that it was the gray coloration.

Although the βάκχος has been identified as the common hake, *Merluccius vulgaris* Cuvier,[171] and as the poor-cod, *Gadus minutus* Linnaeus,[172] the evidence is too scant to justify identifying it any more specifically than as a type of cod or hake similar to or identical with the ὄνος and the ὀνίσκος.

16. Μάξεινος

Dorion[173] gives μάξεινος[174] as a synonym of γαλλερίας and ὀνίσκος. Epicharmus[175] refers to μάζοι and Hesychius to μαζίναι. Xenocrates[176] gives μαζέας as a synonym of ἤπατος, stating that the flesh is rather delicate and of loose texture, lacking compactness. Theophrastus[177] compares the μαζίνης to an Indian fish which went out upon dry land. Μύξον, which may possibly have some connection with these variants, generally denoted a type of gray mullet, perhaps *Mugil auratus* Risso or *Mugil saliens* Risso.[178] Dorion apparently regarded μάξεινος as a term for a type of cod or hake, and it is perhaps of some significance that the bib or pout, *Gadus luscus* Linnaeus, is called mazzia today at Catanzaro.[179] One major objection to this identification is that the bib, as has already been mentioned, is only a wanderer in the Mediterranean and is almost never caught as far east as Greece. Thompson[180] says that since a fish with similar habits is compared to the goby by Theophrastus in the same passage, and since one of the Sicilian vernacular names for the goby is mazzono, μαζίνης may be, *inter alia*, a goby name, although these fish names, in so far as they relate to ἤπατος, γαλλερίας, and ὀνίσκος, point to some member of the cod family.

17. Γάδος

Dorion[181] makes γάδος synonymous with ὄνος, while Hesychius says that the γάδος was called γάλα and sometimes ὄξος, emended by Gossen[182] to γαλαρίας and ὄνος. In the Lexicon of Cyrillus γάλα is also given as a synonym of γάδος.

The origin of this name is obscure.[183] The term γάδαρος, "ass," which appears in Diogenianus,[184] looks like a derivative, as does γαϊδάριον, "ass," which occurs in an Amherst Papyrus of the VI/VII century. These forms have the appearance of an intermediate stage in the development of Modern Greek γαϊδαρόψαρον, "donkeyfish," the usual name of the poutassou, *Pollachius poutassou* Bonaparte (*Merlangus poutassou* Risso),[185] also known as γαδοίψαρον.[186] This species, while common in most of the Mediterranean, becomes rare in the Italian seas; it has flesh of good taste, but soft, and decomposes rapidly.[187] The common hake, *Merluccius vulgaris* Cuvier, is called γαδείψαρον on Crete,[188] and according to Mair[189] is known as γάδος in Greece, although a loan word from Turkish μπακάλης, "grocer," seems to be in more common use, in the form μπακαλάρο or μπακαλιάρος, also written βακαλάος and βακάλης.[190] Gossen,[191] identifying the γάδος with the γαλαρίας and the ὄνος, refers it to the bib, *Gadus luscus* Linnaeus, an implausible identification, as has already been pointed out.

18. Χρέμης

Hesychius gives χρέμυς as a synonym of ὀνίσκος. Whether χρέμυς and the variants

[170] Cf. Hicesius apud Athen. 7.306.e; Plin. *N.H.* 32.77.
[171] Cf. Külb in Steier, *op. cit.* (see note 153): 82.
[172] Cf. Gossen, "Hesych." (see note 39), no. 213; "Athen." (see note 32): 261.
[173] Apud Athen. 7.315.f.
[174] Sic A; μιξῖνος C.
[175] Apud Athen. 7.322.b (in Kaibel, *Comicorum graecorum fragmenta*: 103).
[176] *Alim. aquat.* 10 (exc. Oribas. *Coll. med.* 2.58.27). Μαζέας is feminine in E and Gesner, masculine in E 2ᵉm, ἡμαζέας in ABC, ἡμαζέας in MNV.
[177] Frg. 171 Wimmer (apud Athen. 8.332.b).
[178] Cf. Aristot. *Hist. an.* 543 b 14; 570 b 2; Hices. apud Athen. 7.306.e; Diphil. *ib.* 8.356.d.
[179] Cf. *La pesca nei mari* (see note 4) **3**: 50.
[180] *Op. cit.*: 152–153.
[181] Apud Athen. 7.315.f.
[182] "Hesych." (see note 39), no. 338.
[183] According to Wharton (*Etyma graeca*, s.v.), it is of Semitic origin; but according to Muss-Arnold (Trans. Amer. Philol. Assoc. **23**: 102. 1892), this is very doubtful.
[184] 5.36.
[185] Cf. Hoffman-Jordan, *op. cit.* (see note 28): 276; N. C. Apostolidès, *La pêche en Grèce*, ed. 2: 29. Athens, 1907.
[186] Cf. D. Bikélas, "Sur la nomenclature moderne de la faune grecque," Ann. Assoc. Encourag. Études Grecques **12**: 227. 1878.
[187] Cf. Day, *op. cit.* (see note 16) **1**: 292.
[188] Cf. Badham, *op. cit.* (see note 98): 352.
[189] Introd. of his ed. of Oppian: lxv.
[190] Cf. Apostolidès, *loc. cit.* (see note 185); Hoffman-Jordan, *op. cit.* (see note 28): 277.
[191] "Hesych." (see note 39), no. 338.

χρέμης, χρέμις, and χρέμψ should be regarded as distinct from χρόμις, χρόμιος, and χρόμυς is debatable. Brands[192] maintains that χρόμις, together with χρέμης and χρέμυς, is related to χρεμετίζειν, "neigh," and χρόμος, defined by Hesychius as "a kind of noise," to which can be added χρόμαδος, "a grating, creaking sound." He explains χρόμις as meaning "gnasher," applied to the fish because it uttered a sound. Strömberg[193] accepts Brands' etymology of χρόμις and χρόμης, suggesting that the variant χρέμυς may have arisen by contamination of χέλυς, "turtle." But he thinks that χρέμψ may be a retrograde formation from χρέμπτεσθαι, "to clear one's throat."

Aristotle speaks of the sharp hearing of the χρόμις[194] and of the grunting sound it makes,[195] classifies it as a shoal fish that spawns once a year,[196] and mentions the otolith it has in its head.[197] Pliny[198] speaks of the flashing gleam of the chromis in the water, and Ovid[199] calls it unclean (*immunda*). Aelian[200] says that the χρέμης has a larger barbel than the γαλῆ, which has a larger barbel than the ἤπατος. Oppian[201] says that the χρέμης lives in the sea not far from rivers or lakes, where the water is somewhat less salty and considerable silt is in suspension. Aristotle[202] mentions the χρέμψ in the same passage as the χρόμις as a fish with sharp hearing. Mair[203] suspects that χρεμψhere is a mere variant reading for χρόμις and should be omitted, but it may well denote a different fish.

The χρόμις of Aristotle has been identified by Cuvier,[204] J. Müller,[205] Aubert-Wimmer,[206] Külb,[207] Schmid,[208] Brands,[209] and others as the maigre, *Sciaena aquila* Risso, generally called μυλοκόπι in Modern Greek,[210] but κρανιός at Chalcis and chro at Marseille.[211] Mair[212] is inclined to concur in this identification. Gossen identifies the χρόμις of Hesychius as the gurnard, *Trigla gurnardus* Linnaeus,[213] and with regard to Hesychius' equation of ὀνίσκος with χρέμυς, he says[214] that if the word is equivalent to χρόμις, it also denotes the gurnard, as in Oppian.[215] He similarly identifies[216] the χρόμυς of Aelian, on the ground that it could hear well[217] and grunted.[218] He refers[219] the κρέμυς that had an otolith in its head[220] to the related species *Trigla pini* Bloch. But he identifies the χρέμυς of Aelian[221] as the bearded ophidium, *Ophidium barbatum* Linnaeus, which is common throughout the Mediterranean and in the Adriatic, but has coarse flesh that is inferior as a food.[222] Thompson,[223] who regards these names as variants, says that they denote *Sciaena aquila* and sometimes *Umbrina cirrhosa*. Aelian's account of the χρέμης in particular, he says, suggests the latter species, which has so conspicuous a barbel, or knob, below its chin that fishermen at Bayonne and Arcachon call it verrue, or bourrugue or bourruget, a word meaning "wart."

Unless Heshchius' equation of ὀνίσκος with χρέμυς is an outright error, χρέμυς and its variants χρέμις, χρέμης, and χρέμψ must have been used, although infrequently, as terms for a type of cod or hake, possibly *Phycis* sp. and *Motella* sp., and should therefore be regarded as distinct in usage from χρόμις and its variants, even though these words may all be cognates. This hypothesis is rendered more plausible by the fact that Aelian associates the χρέμης closely with the γαλῆ and the ἤπατος and uses χρόμυς as a term for a distinctly different kind of fish.

19. Φυκίς

Another fish name that merits discussion in connection with the gadoids is φυκίς. Aris-

[192] *Op. cit.* (see note 57): 184.
[193] *Op. cit.* (see note 59): 66–67.
[194] *Hist. an.* 534 a 8; cf. Plin. *N.H.* 10.193.
[195] *Ibid.* 535 b 16.
[196] *Ibid.* 543 a 2.
[197] *Ibid.* 601 b 29; cf. Plin. *N.H.* 9.57; Aelian. *Nat. an.* 9.7; Aristot. apud Athen. 7.305.d (p. 296 Rose).
[198] *N.H.* 32.153. Pliny also attributes nest-building to the chromis; but this is an error arising from hasty reading of Ovid. *Hal.* 121–122. On this point, cf. esp. E. de Saint-Denis, "Quelques bévues de Pline l'Ancien dans ses livres des poissons," Rev. Philol. **18**: 156–157. 1944.
[199] *Hal.* 121. [200] *Nat. an.* 15.11. [201] *Hal.* 1.112.
[202] *Hist. an.* 534 a 8.
[203] Note on Oppian. *loc. cit.*
[204] *Op. cit.* (see note 61) **5**: 41.
[205] Arch. Anat. 1857: 259.
[206] *Aristoteles Tierkunde* **1**: 144.
[207] *Aristoteles*, p. 603.
[208] "Die Fische in Ovids Halieuticon," Philologus, Supplementband **11**: 305. 1907–10.
[209] *Loc. cit.*
[210] Cf. Apostolidès, *op. cit.* (see note 185): 13.
[211] Cf. Cuvier, Ann. Inst. Archéol. 1842: 73.
[212] Cf. note on Oppian. *Hal.* 1.112.
[213] "Hesych." (see note 39), no. 2343.
[214] *Ibid.*, no. 2341.
[215] *Hal.* 1.112.
[216] "Aelian' (see note 32), par. 128.
[217] *Nat. an.* 9.7.
[218] *Id.* 10.11.
[219] "Athen." (see note 32), p. 256.
[220] Aristot. apud Athen. 7.305.d.
[221] *Nat. an.* 12.11.
[222] Cf. Day, *op. cit.* (see note 16) **1**: 326.
[223] *Op. cit.*: 291–292.

totle[224] states that oviparous fish as a rule spawn but once a year, but that the small φυκίδες are an exception, spawning twice a year, The male, moreover, differs from the female in being blacker and having larger scales. Elsewhere[225] he classifies the φυκίς among the fish that feed habitually on mud or seaweed or sea moss or the so-called stalk weed or growing plants and remarks that the only meat it will touch is that of prawns. In the light of his comment on the fish's diet, it is noteworthy that φυκίς is apparently a derivative of φῦκος, "seaweed," probably applied to the fish either because it fed on seaweed or because it was commonly found among seaweed.[226] Aristotle[227] in another passage says that the φυκίς, like the κόττυφος and the κίχλη (probably *Crenilabrus pavo* Cuvier and Valenciennes and *Coricus rostratus* Cuvier and Valenciennes), changes its color. Usually it is white, but in spring it is mottled; and it is the only fish that builds a nest for itself, the female laying her spawn in this bed or nest. In still another passage[228] he describes the φυκίς as being sticklebacked and having a speckled skin. Plutarch[229] and Ovid[230] also refer to this habit of building a nest. Pliny[231] translates the above passage of Aristotle almost verbatim and in another passage[232] classifies the phycis as a rockfish. Other authors also classify it as a rockfish,[233] and it is so defined in various lemmas.[234]

The reference to nest-building led Cuvier[235] to identify the φυκίς as the black goby, *Gobius niger* Linnaeus, an identification originally approved by Thompson,[236] who referred to Aristotle for support. According to Aubert-Wimmer,[237] Aristotle's allusion to stickles pointed to the stickleback, *Gasterosteus aculeatus* Linnaeus, and the 10-spined stickleback, *Gasterosteus pungitius* Linnaeus, which build nests, or to *Gobius niger*, the former being the more attractive identification. But Mair[238] says that it is now known that some at least of the wrasses build nests and that all the other evidence points to one of the wrasses. He calls attention to the fact that the scholiast on Oppian[239] equates φυκίδες with λαπίναι and concludes from the fact that *Crenilabrus pavo* is called λήπαινα in Modern Greek,[240] λαπίνα μαύρη and λαπίνα μεγάλη at Chalcis,[241] that it is likely that this is the φυκίς of the ancients. Thompson[242] subsequently identified the φύκης or φυκίς as a wrasse, perhaps especially *Labrus mixtus* Linnaeus, but confused at times with the gobies, which are also nest-builders.

Numerous variants of lapina and lapaina are found in Italy and Sicily, mostly denoting *Crenilabrus pavo* and allied species. These apparently go back to a Latin form labeo "big-lipped."[243] Italian fico, which probably goes back to the root of φυκίς, is discussed at considerable length by Barbier,[244] who says that in the Italian-English dictionary of Florio (1688) phici, phiscide, fici, fico are defined as follows: "a fish that is sometimes white and sometimes thick with black spots, and frames itself a nest in the grass or reeds by the sea-side, and there deposits its spawn and sits on the young, known in Rome as *fico*." Barbier assumes from the definition that this is the phycis of Rondelet,[245] who described the fish in very similar terms and says that it was called mole by the French, phyco by the Italians, molere by the Spaniards, and sometimes pittara at Naples. This fish is *Phycis mediterraneus* De la Roche, and Barbier found this identification of the φυκίς of the ancients more acceptable than the one made by

[224] *Hist. an.* 567 b 18.
[225] *Ib.* 591 b 10.
[226] Cf. Brands, *op. cit.* (see note 57): 182. Strömberg (*op. cit.* [see note 59]: 83) suggests the following factors: (1) The fish fed on seaweed; (2) it changed color with the seasons like certain types of seaweed; and (3) it built a nest in the midst of algæ and seaweed.
[227] *Hist. an.* 607 b 18; cf. Aelian. *Nat. an.* 12.28; Plin. *N.H.* 9.81.
[228] Apud Athen. 7.319.c.
[229] *Mor.* 981.f (*De sollertia animalium* 33).
[230] *Hal.* 122.
[231] *N.H.* 9.81.
[232] *Id.* 32.150.
[233] Cf. Ps.-Hippocr. *De diaet.* 2.48; Galen. *Alim. fac.* 3.27,29 (pp. 367.1 and 368.3 Helmreich); *Vict. att.* 8.59 (p. 442.16 Helmreich); Oribas. *Coll. med.* 3.2.10; Diocles apud Athen. 7.305.b; Numen. *ib.* 7.319.b; Oppian. *Hal.* 1.126.
[234] Cf. Papendick, *op. cit.* (see note 31): 4, 7.
[235] *Op. cit.* (see note 61) **4**: 151; **12**: 7.
[236] Note on Aristot. *Hist. an.* 567 b 20.
[237] *Op. cit.* (see note 206) **1**: 142.
[238] Introd. to his ed. of Oppian: li–liii.
[239] *Hal.* 1.126.
[240] Cf. Th. von Heldreich, *La faune de la Grèce* (Athens, 1878).
[241] Cf. Apostolidès, *op. cit.* (see note 185): 26.
[242] *Glossary*, p. 276.
[243] Cf. Cl. Merlo, "Note etimologiche e lessicali," Atti Accad. Sci. Torino **42**: 19. 1906–1907. H. Schuchardt, Zeitschr. roman. Philol. **31**: 641–646. 1907.
[244] *Op. cit.* (see note 104): 34–37; cf. also Meyer-Lübke, *op. cit.* (see note 19): 534.
[245] *Libri de piscibus marinis* 6 (x): 186–188. Lugduni, 1554.

Cuvier. More recently Gossen[246] has advanced the same identification.

Barbier comments on the possibility that names from the root of *φυκίς* were applied to various fishes, in view of the variants *φυκίς*, *φύκην*, and *φύκης*. Rondelet[247] believed that the *φυκίς* and the *φύκην* were different fishes. Brands,[248] recognizing only two variants, *φυκίς* and *φύκης*, the former feminine and the latter masculine, says that while the former may have denoted the female and the latter the male of the same species, it is more probable that the two denoted different fishes. Barbier cites from Carus[249] as examples of fish names from the root of *φυκίς* the following: (1) fico at Rome, fica at Naples, and figo at Venice for *Phycis mediterraneus* De la Roche; (2) baca ficu and pesce ficu in Sicily, figora at Rome, fica at Naples, pesce fica at Palermo, and pisci ficu at Messina for *Gadus minutus* Linnaeus; (3) Italian fico for *Gadus luscus* Lacépède; and (4) Italian pesce fico "codfish" (Florio) and figaotto at Genoa for *Gadiculus blennioides* Günther. He goes on to say that the root of *φυκίς* has also been the source of names for other fishes than gadoids and their close relatives, but that these names always refer to fishes which frequent seaweed or feed on it. *Sciaena aquila* Risso, for example, bears such names as figoun and figou in the Provence (figon at Nice), fagao at Genoa (fegaro, according to Bonaparte; figau, according to Sassi), figao on Elba, fico at Tunis, and French fégaro at Damiette. Schuchardt[250] givea figa and figo as names for *Stromateus fiatola* Linnaeus at Adria (also called figa at Venice and figo at Trieste, according to Carus) and figa at Spalato for *Labrus bimaculatus* Linnaeus (*Labrus mixtus* Linnaeus). He explains these names as an allusion to the color of the fish, and Barbier, assuming that he derives them from Latin *ficus*, *fica* "fig," characterizes the application as farfetched, in view of the coloration of *Stromateus fiatola*, which in no respect resembles that of a fig. He believes that these names also go back to the root of *φυκίς*. Modern Greek *φυκόψαρο* is a generic term for any species of wrasse.[251]

One factor of importance which has been given almost no consideration is that *φυκίς* is in no ascertainable instance equated with a name identifiable as one of the gadoids, and it has already been noted that one of the primary difficulties met in idenifying names applied to gadoids is a marked tendency to make these names mutually synonymous. As a result, it is generally easy to recognize that a given name belongs in the gadoid group, but often impossible to assign it with certainty to any particular species. It seems almost certain that the *φυκίς* was a type of nest-building wrasse, and Mair's identification is probably correct. At the same time, it is possible that a Latin name from the root of *φυκίς*, unrecorded in the extant literature, was applied not only to certain types of wrasse, but also to certain gadoids, in both cases because the fishes were closely associated with seaweed.

20. Λελεπρίς

For the reasons given above, the λελεπρίς defined by Hesychius as a name for the *φυκίς* and mentioned by Pliny [252] in connection with the *phycis*, identified by Gossen[253] as perhaps *Phycis mediterraneus* De la Roche, should be referred to the wrasses.

21. Βρύττος

Hesychius defines *βρύττος* as a kind of pelagic echinoderm, also the name of a fish. The echinoderm, mentioned by Aristotle,[254] is probably *Brissus unicolor* Klein. Gossen[255] identifies the fish as perhaps *Physiculus dalwicki* Kaup, a small gadoid which resembles a sea-urchin. Thompson[256] does not venture an identification.

22. Asellus

Latin asellus, "assfish," is approximately equivalent to and perhaps a translation of Greek *ὀνίσκος*. It is often equated with *ὀνίσκος* in lemmas,[257] as it is in Cassius Felix.[258] Pliny,[259] moreover, uses asellus to translate Aristotle's *ὄνος*. Asellus, *ὄνος*, and *ὀνίσκος* all mean "assfish," asellus and *ὀνίσκος* being diminutive

[246] "Hesych." (see note 39), no. 507; "Aelian" (see note 32), par. 140; "Athen." (see note 32): 262.
[247] *Loc. cit.*
[248] *Op. cit.* (see note 57): 182.
[249] *Op. cit.* (see note 5) **2**: 573.
[250] *Op. cit.* (see note 243): 645; cf. also 28 (1904): 443.
[251] Cf. Apostolidès, *op. cit.* (see note 185): 25; Hoffman-Jordan, *op. cit.* (see note 28): 269, 270.
[252] *N.H.* 32.149.
[253] "Hesych." (see note 39), no. 1266.
[254] *Hist. an.* 530 b 4.
[255] "Hesych." (see note 39), no. 328.
[256] *Glossary*: 36.
[257] E.g., *Hermen. Amplon.* 89.2,37; *Hermen. Leid.* 16.54; *Hermen. Vat.* 436.34; *Hermen. Monac.* 187.2.
[258] 28 (p. 44.17 Rose).
[259] *N.H.* 9.61; 32.145.

formations; and asellus, like the Greek names, refers to the color of the fish.[260] Pliny speaks of two kinds of asellus, the collyrus (or callarias) and the bacchus, of which the bacchus, a larger type, was preferred because it was caught only in the deep sea.

Barbier[261] identifies the asellus of Pliny as the common hake, *Merluccius vulgaris* Fleming, an identification which receives some support from the Romance nomenclature. Rondelet[262] reports that in his day this species was called asello and nasello in Liguria, and Faujas and Sassi report nasello as current at Genoa.[263] Today this species is called asinel at Fiume, naselli at Genoa, and nasello at Ancona.[264] In addition, Barbier cites Rolland as giving nasello as current on Elba and Malaspina as giving nasell as current at Parma. He also calls attention to French anon and anon de mer as names for the eglefin, *Gadus aeglefinus* Linnaeus. Italian nasello is reported as a name for *Merlucius cyprinus* by Meyer-Lübke,[265] although there is no confirmation from other sources. Badham[266] believed that the asellus was the sea-tench, *Phycis mediterraneus* De la Roche, better known as the Mediterranean hake. On the basis of the Romance nomenclature, the asellus is more plausibly referred to the common hake. Since Pliny indicates that the name was applied to at least two types, one of these would be the common hake and the other possibly the Mediterranean hake or the fork-beard hake, *Phycis blennioides* Bloch and Schneider.

23. Asinus

The fish name asinus appears in Polemius Silvius[267] in the form asinis. As asellus is equivalent to ὀνίσκος, so asinus is equivalent to ὄνος. This name is almost certainly, like the others, an allusion to the ass-gray color of the fish.[268] The evidence is insufficient to permit a specific identification, but it may be noted that Rondelet[269] reported asino as a current Italian name for the common hake, *Merluccius vulgaris*, and Thompson[270] cites asinel at Fiume for this species.

The conclusions reached relative to the meanings of the ancient names may be summarized as follows:

GREEK NAMES

1. Βάκχος (sect. 15): Apparently a name for one of the gadoids, as well as a type of scienid and a type of gray mullet.

2. Βρύττος (sect. 21): Possibly the small gadoid *Physiculus dalwicki* Kaup, although this is very uncertain.

3. Γάδος (sect. 17): One of the gadoids, similar to the ὄνος and the ὀνίσκος.

4. Γαλῆ (sect. 2): When the habitat is the sea, it may denote *Phycis* sp. and *Motella* sp. When it refers to a freshwater fish, it probably denotes principally the burbot, *Lota vulgaris* Cuvier, but also probably sometimes the lamper-eel, *Petromyzon fluviatilis* Linnaeus.

5. Δελκανός (sect. 5): Probably the burbot, *Lota vulgaris* Cuvier.

6. Ἤπατος (sect. 3): One of the larger marine gadoids, possibly a type of ling.

7. Καλλαρίας (sect. 11): Probably one of the smaller marine gadoids.

8. Λαζίνης (sect. 12): Possibly one of the gadoids.

9. Λεβίας (sect. 4): When the habitat is the sea, it denotes one of the marine gadoids. As a lake fish, it is probably the burbot, *Lota vulgaris* Cuvier. As a Nile fish, it is probably *Labeo niloticus* Cuvier.

10. Λελεπρίς (sect. 20): A type of wrasse.

11. Μάξεινος (sect. 16): One of the gadoids.

12. Ὀνίας (sect. 10): A descriptive term, not a fish name.

13. Ὀνίσκος (sect. 9): Probably denotes the common hake, *Merluccius vulgaris* Cuvier.

14. Ὄνος (sect. 8): Probably denotes the Mediterranean hake, *Phycis mediterraneus* De la Roche, and the fork-beard hake, *Phycis blennioides* Bloch and Schneider.

15. Ὄξος (sect. 13): Probably a ms. error for ὄνος.

16. Πρέπων (sect. 6): Probably one of the larger marine gadoids.

17. Πρόβατον (sect. 7): Probably one of the larger marine gadoids.

18. Φυκίς (sect. 19): A type of wrasse, probably *Crenilabrus pavo* Cuvier and Valenciennes.

19. Χρέμψης (sect. 18): Possibly denotes *Phycis* sp. and *Motella* sp.

[260] Cf. Varro *Ling.* 5.77 and note of R. G. Kent *ad loc.*
[261] *Op. cit.* (see note 104): 26.
[262] *Op. cit.* (see note 245) **9** (ix): 272–276.
[263] Cf. Carus, *op. cit.* (see note 5) **2**: 573.
[264] Cf. *La pesca nei mari* (see note 4) **3**: 95, 60, 31.
[265] *Op. cit.* (see note 19): 56.
[266] *Op. cit.* (see note 98): 350–353.
[267] *Chron. min.* I, 544, 6. Cf. H. Schuchardt, "Zu den Fischnamen des Polemius Silvius," Zeitschr. roman. Philol. **30**: 719. 1906. Thompson (*Glossary*, p. 183), unjustifiably, it appears, suspects an error in copying Plin. *N.H.* 9.61.
[268] Cf. Barbier, "Noms de poissons," Rev. Langues Romanes **54**: 151. 1911.
[269] *Loc. cit.* (see note 261).
[270] *Glossary*: 97.

LATIN NAMES

1. ASELLUS (sect. 22): Probably principally the common hake, *Merluccius vulgaris* Cuvier, possibly also the Mediterranean hake, *Phycis mediterraneus* De la Roche, or the fork-beard hake, *Phycis blennioides* Bloch and Schneider.

2. ASINUS (sect. 23): Possibly the common hake, *Merluccius vulgaris* Cuvier.

3. GALAXIAS (sect. 14): Possibly a synonym of mustella, used more particularly as a term for *Phycis* sp. and *Motella* sp.

4. MUSTELA (sect. 1): When the habitat is the sea, it probably denotes *Phycis* sp. and *Motella* sp. When it refers to a freshwater fish, it denotes principally the burbot, but probably also sometimes the lamper-eel, *Petromyzon fluviatilis* Linnaeus.

The major applications of ancient names to various species of gadoids were as follows:

1. *Phycis mediterraneus* De la Roche and *Phycis blennioides* Bloch and Schneider: Usually called mustela in Latin, perhaps also asellus and galaxias. Usually called ὄνος in Greek, perhaps also γαλῆ and χρέμψης.

2. *Merluccius vulgaris* Cuvier: Usually called ὀνίσκος in Greek and asellus in Latin, perhaps also asinus.

3. *Motella tricirrata* Nilsson: Usually called mustela in Latin, perhaps also galaxias. Perhaps known as γαλῆ and χρέμψης in Greek. *Motella mustela* Nilsson: Usually called mustela in Latin, perhaps also galaxias.

4. *Lota vulgaris* Cuvier: Known as mustela in Latin and as γαλῆ, λεβίας, and δελκανός in Greek.

5. *Molva elongata* Risso: Perhaps known in Greek as ἤπατος.

There is little evidence that codfishes were much esteemed as food fish by the Greeks. Archestratus[271] says that ὄνοι of respectable size were caught at Anthedon, but that he personally found the flesh rather spongy and unpalatable, although others praised it highly. Anaxandrides[272] mentions ὄνοι as a banquet item; Diphilus[273] says that the λεβίας was popular among the Rhodians; and Archestratus[274] speaks of buying both the λεβίας and the ἤπατος at Delos and Tenos.

[271] Apud Athen. 7.315.f (frg. 35 Ribbeck, frg. 14 Brandt).
[272] *Ib.* 4.131.e (in Kock, *Comicorum Atticorum fragmenta* **2**: 151).
[273] *Ib.* 4.132.d.
[274] *Ib.* 7.301.d (frg. 30 Ribbeck, frg. 27 Brandt).

When we turn to the Romans, we find a different picture. Ennius[275] considered the marine mustela superior to all other fishes when caught at Clipea, and Pliny[276] ranked it second only to the parrotfish in his time, although it was esteemed chiefly for its liver. The mustela of the Lake of Constance, which must be the burbot, in his opinion compared favorably in excellence of taste with the marine mustela. As for the asellus, Pliny[277] says that in former times the asellus and the sea-bass ranked second only to the sturgeon. It was still in high favor not long before his time, for in the reign of Nero there was a saying, *post asellum diaria non sumo* ("After an asellus I don't take ordinary fare").[278] Ovid,[279] moreover, considered the asellus quite unworthy of such an ugly name. According to Varro,[280] the best specimens were caught off Pessinus in Galatia. In view of the obvious esteem in which the asellus was held, it is somewhat surprising to find that the only use made of it in the cookbook of Apicius is in grated form as an ingredient in an elaborate milk dish.[281] Possibly this is a reflection of Greek taste.

The ancient physicians were inclined to regard codfishes with favor from the dietetic point of view. Galen considered the ὄνος and the ὀνίσκος tender and relatively easy to digest,[282] although he deemed ὀνίσκοι taken off river mouths somewhat inferior and more difficult to digest.[283] Xenocrates[284] says that the flesh of the ὀνίσκος is difficult to assimilate, but easy to pass, and nourishing. In another passage,[285] he approves the flesh of the ἤπατος and the μαζίας as being of good taste, although hard to digest, but nourishing and easily passed. Oribasius[286] recommends the ἤπατος as providing a nourishment that is excellent for feeble persons and invalids. Euthydemus[287] remarks that the δελκανός is very wholesome when pickled in brine.

[275] *Heduph.* 1 (apud Apul. *Apol.* 39).
[276] *N.H.* 9.63.
[277] *Id.* 9.61.
[278] Petron. 24.7.
[279] *Hal.* 133.
[280] *Men.* 403 (apud Gell. 6.16.5).
[281] 4.133.
[282] *Alim. fac.* 3.29,40 (pp. 368, 384 Helmreich).
[283] *Alim. fac.* 3.29 (p. 368.21 Helmreich).
[284] *Alim. aquat.* 14.
[285] *Id.* 10 (exc. Oribas. *Coll. med.* 2.58.27).
[286] *Coll. med.* 3.15.7.
[287] Apud Athen. 3.118.b.

ARCHEOLOGY.—*A Veraguas grave.*[1] KARL P. CURTIS, Gamboa, C. Z., and GORDON R. WILLEY, Bureau of American Ethnology.

The archeological culture area of Veraguas has been defined as that part of the modern Panamanian province of the same name which lies on the Pacific side of the continental divide. As such it embraces the coast from the Río Tabasara to the southwestern extremity of the Azuero Peninsula. Inland the extent of the Veraguas culture is as much as 50 miles in some places; however, distributions are not well known. The distinctiveness of Veraguas as a culture area is well emphasized by the two archeological regions which flank it. On the east is the better-known Coclé area and to the west the Chiriquí. The Veraguas ceramic, metallurgical, stone, and grave-type styles differ markedly from those of these neighboring areas. The time-depth of the Veraguas culture is an unknown quantity as is that of Coclé or Chiriquí, but it is believed that all three of these major complexes of Pacific Panama belong to the late periods, that is, the two or three centuries prior to Spanish discovery in the early sixteenth century.

As data on Veraguas are so few,[2] it is the purpose of this little paper to place on record a grave of this culture type and its contents. The scientific significance of the grave lies solely in the fact that it is an associational unit.

The grave in question was excavated by the senior author during the last week in January 1948. Notes pertaining to the excavations and the collection were studied by the junior author in April of the same year. The collection is now in the possession of the National Museum of Panama, R. P.

The site at which the excavation was made lies about 23 miles northwest of the city of Soná in what is probably the heart of the Veraguas culture area. Espala is the nearest community. This is hilly upland country, and the site, which is a cemetery, is on the top of a hill about a mile distant from the house of Juan Perez, the owner of the property. By early 1948 some 50 or 60 shaft graves in the cemetery had been looted by treasure-hunters. The particular grave opened by the senior author was first detected by surface indications in the form of a crude circle of stones, each partially imbedded in the soil. This circle measured 9 feet in diameter and showed a slight central depression where the fill of the grave had settled. The tubular grave shaft also proved to be about 9 feet in diameter from top to bottom, a depth of 14 feet. The shaft was filled with tightly packed clay rubble mixed with small stones and charcoal. The grave chamber at the terminus of the shaft was simply an enlargement of the former. It was floored with clay and flat stones.

No human skeletal material was found in the chamber, but seven pottery vessels, four stone celts, nine chipped stone projectile points, and some minor miscellaneous items were recovered. These materials are described below. They are listed by the temporary catalogue numbers assigned to them at the time of study.

POTTERY

The ware qualities of all seven vessels are virtually identical. The paste is uniformly sandy and, in addition, is tempered with occasional particles of large grit and crushed white rock. It is fairly homogeneous but friable and crumbly. The vessels are fired to a buff or reddish buff throughout, although there are occasional black firecloudings spotted on the surface. Most of the vessels seem to have been buff-slipped, and the exterior surfaces are usually well smoothed or even polished. Vessel walls average 7–8 mm. in thickness. All decoration is achieved by plastic techniques.

$\frac{1}{C\text{-}48}$. A subglobular bowl on a high pedestal base (Fig. 1, *a*). Vessel body has a sharp shoulder angle, and on this angle there is an encircling

[1] Received October 27, 1948.

[2] See S. K. LOTHROP, *The archeology of Panama*, Handbook of South American Indians (Bur. Amer. Ethnol. Bull. 143) **4**: 144, 159–160, 1948. Dr. Lothrop now has in press (Mem. Peabody Mus. Arch. and Ethnol., Harvard University) a major work on Veraguas. Aside from Lothrop's studies there are no published accounts of Veraguas archeology.

flange which extends upward and outward forming a "gutter." This flange is terminated on opposite sides of the vessel to allow for the placement of adorno figures. The total diameter of the vessel, including the shoulder flange, is 30 cm. The pedestal base is wide and high, although it has been broken and partially restored.

Decoration is by relief modeling and punctation. The edge of the shoulder flange is marked with a double row of round-dot punctations plus crimping or scalloping. The adornos are modeled frog figures. One is partially destroyed, but the other shows a large, flat-topped head, large ears, round button-punctated eyes with appliqué brow ridges, rachitic arms, huge hands, and male (?) genitalia. These frog adorno figures are hollow, and on the inside of the vessel small holes open through into the interior chambers of the adornos. On the other diameter of the vessel, on opposite sides, are lizards or alligators executed in relief appliqué. These animals face in opposite directions. They have long legs, big hands, large heads, and a serrated back and tail. Features such as eyes, mouth, and hands are delineated by punctations as well as appliqué strips.

$\frac{2}{C\text{-}48}$. A subglobular bowl on a pedestal base (Fig. 1, *b*). The diameter of this bowl is 18 cm. The rim is unmodified; the base is of medium height and is markedly outflared. There are adorno zoomorphic faces on two sides of the bowl located just above the median line. These are done in appliqué strips and punctations. The nose of the face is also a small loop handle. Incised buttons and incisions suggest eyes and mouth. Wings or arms are indicated by arching loops.

$\frac{3}{C\text{-}48}$. A subglobular bowl on a flaring pedestal base (Fig. 1, *c*). Unmodified rim. Maximum diameter is 15.8 cm. There is appliqué decoration on two sides of the bowl. The figure is possibly that of an alligator. Features of punctated pellet eyes and indented arched loops are much like those described for other vessels.

$\frac{4}{C\text{-}48}$. A subglobular bowl with tripodal support (Fig. 1, *d*). Maximum diameter is 13 cm. Legs are 2.5 cm. high. Rim is unmodified. There are two projecting animal heads or adornos on opposite sides of the bowl, and there are punctated arched loops on either side of each head. A small hole has been punched through the vessel wall just above each head. On the other two sides of the vessel are faces indicated by arched and connected brows. These brows join to form a snout or mouth. Eyes below the brows are punched pellets. Vessel legs are slab-like with rounded ends. These legs are also effigy forms, inverted, depicting either humans or birds.

$\frac{5}{C\text{-}48}$. Small bowl on tripodal base (Fig. 1, *e*). Maximum diameter is 5.5 cm. Bowl has low shoulder angle and slightly everted rim. Feet supports are V-shaped slabs. No decoration.

$\frac{6}{C\text{-}48}$. Globular miniature vessel on tripod base (Fig. 1, *f*). Two vertical strap handles below rim. Rim is outflared. Feet are round nubbins. Maximum diameter is about 4 cm.

$\frac{23}{C\text{-}48}$. Open bowl on pedestal base (Fig. 1, *g*). This vessel shows the poorest shaping and smoothing of any in the grave lot. Maximum diameter is 7.8 cm. Rim is unmodified. On opposite sides of the vessel, just below the rim, are large nodes. Each is punched as though to represent two eyes. Each is also flanked, on both sides, by two smaller pellet nodes which are plain.

STONEWORK

The four celts $\left(\frac{7\text{-}10}{C\text{-}48}\right)$ are all made of a gray stone with white inclusions. All have a pointed poll, are diamond-shaped in cross section, and are well formed. Three of them are well polished. One shows a marked flare of the bit end (Fig. 1, *h*). They vary in length from 24 to 12 cm, in width from 6.7 to 4.5 cm, and in thickness from 3.8 to 2 cm.

The stone projectiles are all rather crudely chipped, show only heavy retouch, and are all planoconvex in form.

$\frac{11}{C\text{-}48}$. A large projectile of red stone, resembling argillite (Fig. 1, *n*). The blade is ovate-triangular, there is very little shoulder angle, and a stem is only suggested. Length 8.5 cm.

$\frac{12}{C\text{-}48}$. A large projectile of yellow-brown chert (Fig. 1, *o*). One shoulder is quite distinct; the other is only slightly indicated. Blade is ovate-triangular. Stem is tapered. Length 10.5 cm.

$\frac{13\text{-}17 \text{ and } 19}{C\text{-}48}$. Small projectiles (Fig. 1, *i–l*). Triangular or ovate-triangular blades. Shoulder angles and differentiation of stem and blade tends to be vague. Made of yellow-brown chert, grey chert, or reddish argillite (?). Length 5.1 to 3.2 cm.

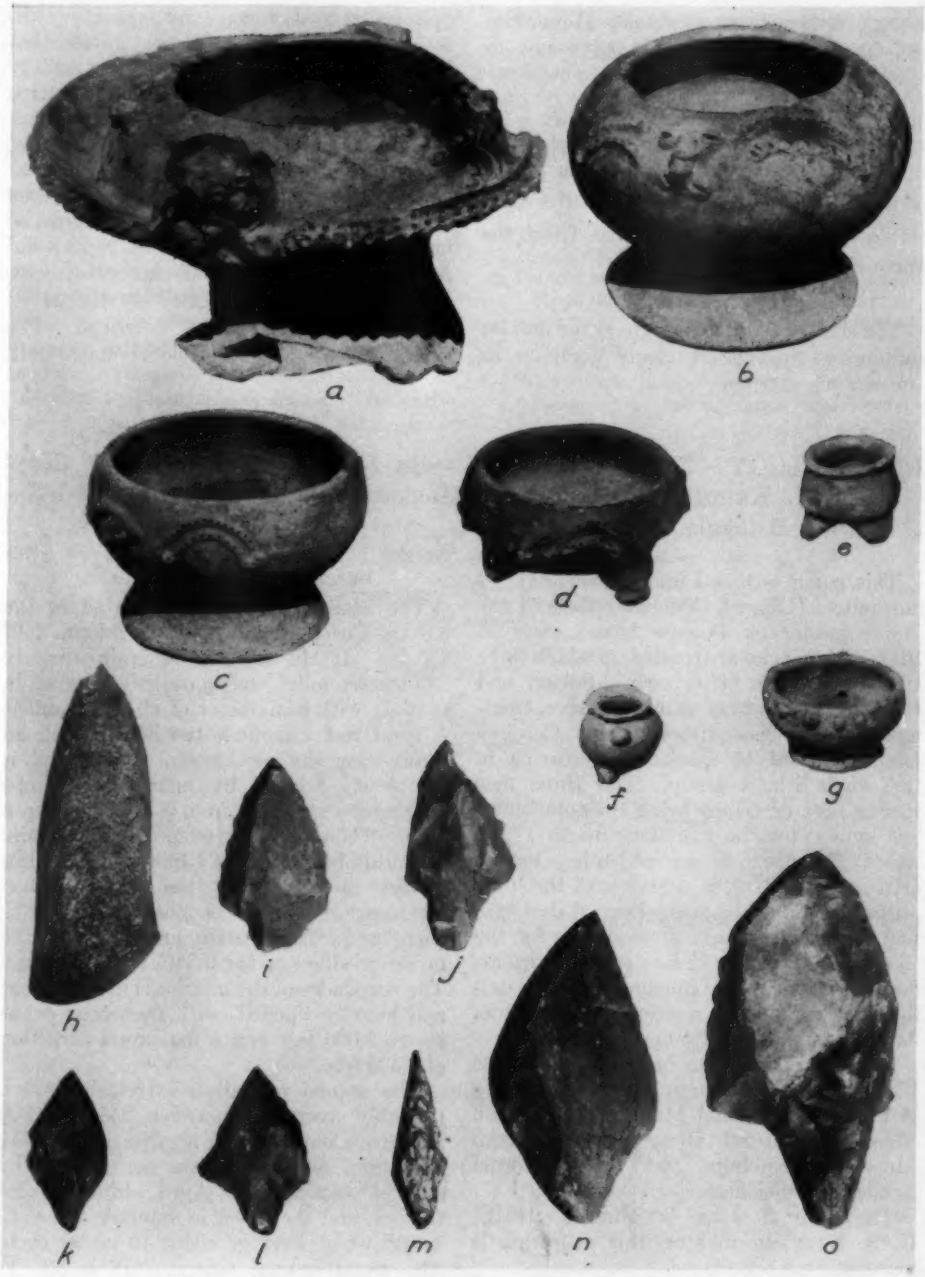


FIG.1.—Veraguas pottery and stonework from Juan Perez site.

$\frac{18}{C\text{-}48}$. A long, core point, also planoconvex (Fig. 1, *m*). As thick as it is broad. Tapered stem. Yellow-brown chert. Length 4.9 cm.

MISCELLANEOUS

Besides the artifacts described, a small lump of amber ($\frac{20}{C\text{-}48}$), a smoothing pebble of heavy ore ($\frac{21}{C\text{-}48}$), and five small quartz crystals ($\frac{22}{C\text{-}48}$) were also taken from the grave chamber.

COMMENT

The similarity of this single grave and its contents to the type picture of Veraguas, as it is drawn by Lothrop (*ibid.*, pp. 159–160), is striking. First, Lothrop states that Veraguas graves and cemeteries are usually located upon hills or mountain ridges, as is the case with the Juan Perez site; second, the grave shaft and chamber of the grave discussed here check very closely with that author's observations; third, the stone celts and chipped blades or points seem to be identical with classic Veraguas types; and fourth, Veraguas pottery forms and decorations are clearly duplicated in the seven vessels which we have described. The assemblage is an indubitable Veraguas unit.

ENTOMOLOGY.—*The mosquitoes of Ponape Island, eastern Carolines.*[1] KENNETH L. KNIGHT[2] and HERBERT S. HURLBUT,[3] Naval Medical Research Institute, Bethesda, Md.

This paper is based upon a collection of mosquitoes (Diptera-Culicidae) made by the junior author on Ponape Island early in 1948. Six species are treated, of which three are described as being new. Bohart and Ingram (1946), in a comprehensive treatment of the mosquitoes of the Caroline Islands, record 14 species as occurring in the whole island group. The three new species here described bring the total number known for the Carolines up to 17, of which 12 appear to be endemic. Farner (1944a and 1944b), in a review of the literature relating to the mosquitoes of the Caroline Islands, lists only three species for the island of Ponape: *Culex quinquefasciatus* Say, *Aedes aegypti* (Linnaeus), and an unidentified small dark mosquito species from Japuteick Island in Ponape harbor.

All holotypes are to be deposited in the U. S. National Museum; and the paratypes in the U. S. National Museum, the British Museum (Natural History), the Bishop Museum, Honolulu, and the California Academy of Sciences.

The help of John I. Thomas, HMC, U. S. Navy, in making this collection is gratefully acknowledged.

[1] Received September 27, 1948.
[2] Lieutenant Commander, MSC, U. S. Navy.
[3] Commander, MSC, U. S. Navy.

DESCRIPTION OF THE ISLAND

The island of Ponape is located in the eastern Carolines (lat. 6° 55′ N., long. 158° 15′ E). It has an area of approximately 145 square miles and is roughly circular in outline, with a diameter of about 13 miles. A coral reef surrounds the island, with an intervening shallow lagoon. The island is completely fringed by mangrove swamps which vary in width from a few yards to a mile. There is little or no coastal plain. A foothill belt of about 1 mile in width rises almost directly from the water's edge. There are extensive coconut groves in this zone, and cleared areas are found in the broader valleys on the north, west, and east. The remainder of the interior is mountainous and heavily wooded, with numerous peaks above 2,000 feet and a maximum elevation of 2,595 feet.

The annual rainfall is extremely heavy, probably averaging between 255 and 300 inches at Colonia on the north coast. There are about 300 rainy days per year. The wettest months are April through September, and the driest in January and February, which average about 10 inches each. The mean annual temperature is 83° F. There is little seasonal variation. The winds are south to southeast in August to October and northeast the rest of the year.

The strongest winds occur from December to March.

The island is divided into five civil districts: Not, U, Matalanim, Kiti, and Sokas, in a pielike arrangement proceeding around the coast in a clockwise direction. The largest settlement is at Colonia on the north side, where the Civil Administration Unit is located. Other small settlements are located at Matalanim on the east coast and at Ronkiti and Wani Kiti on the west. The interior is uninhabited. The localities indicated on the sketch map (Fig. 1) are not villages in the usual sense but groups of widely separated dwellings scattered over areas of a square mile or more. The native population is Micronesian and totals about 5,000. There is little agriculture except for small patches of yams, taro, sugarcane, and bananas. Most of the coast is accessible only by trails and by boat. About ten miles of motor road exist on the north side. The interior has no roads and only a few trails.

KEY TO THE ADULTS

1. Tarsi dark.....2
   Tarsi with definite pale markings.....4
2. Pleuron prominently marked by 2 longitudinal broad dark integumental bands, the ventral one terminating medially on sternopleuron; no pleural scale patches.....
   ..*Culex* (*Culiciomyia*) *pullus maplei*, n. subsp.
   Pleuron not marked by dark integumental bands; 3 or more pleural scale patches present.....3

FIG. 1.—Map of Ponape Island. Specific localities labeled are those where collections were made.

3. Scutellum with narrow black scales (usually a variable number of narrow yellow scales present basally); postspiracular bristles present; scutum clothed with sparse hairlike black scales and marked with several rather indefinite patches of yellow scales..... ..*Aedes* (*Aedimorphus*) *senyavinensis*, n. sp.
Scutellum with narrow pale yellowish scales; no postspiracular bristles; scutum clothed with narrow brownish-yellow to brownish scales..*Culex* (*Culex*) *quinquefasciatus* Say
4. Proboscis banded; dorsal vertex scales narrow .....*Culex* (*Culex*) *annulirostris* Skuse
Proboscis dark; dorsal vertex scales nearly all broad.....5
5. Fifth hind tarsal segment all white; scutum with a pair of thin admedian longitudinal pale lines and a rather broad crescent-shaped area of broad silvery scales on lateral margin over *ppn*..... ...*Aedes* (*Stegomyia*) *aegypti* (Linnaeus)
Fifth hind tarsal segment with at least apical half dark; scutum with a complete median longitudinal pale band that tapers posteriorly to prescutellar area and there forks to posterior scutal margin..... ....*Aedes* (*Stegomyia*) *hakanssoni*, n. sp.

KEY TO THE PUPAE

1. Only 1 terminal hair present on each paddle (*Aedes*).....2
Two terminal hairs present on each paddle, one dorsal and the other ventral (*Culex*).....4
2. Paddles with a prominent marginal fringe of long hairs (Fig. 11).....*hakanssoni*, n. sp.
Paddles not possessing a marginal fringe of hairs.....3
3. Hair 8 on abdominal segments II–VI prominent and distinctly spinelike in form; posterior half of paddle margin distinctly denticulate (Fig. 14).....*aegypti* (Linnaeus)
Hair 8 on abdominal segments II–VI very small and not spinelike; posterior half of paddle margin smooth and rather indistinct (Fig. 15) .....*senyavinensis*, n. sp.
4. Hair 5 on abdominal segments IV–VI double (rarely single) (dorsal paddle hair approximately twice length of ventral hair)..... .....*quinquefasciatus* Say
Hair 5 on one or more of segments IV–VI with more than 2 branches..... 5
5. Hair 5 on abdominal segments V and VI with 2 or 3 branches; metathorax largely, or entirely, brown.....*annulirostris* Skuse
Hair 5 on abdominal segments V and VI nearly always with 5 or 6 branches; lateral half, or more, of the metathorax unpigmented (clear).....*pullus maplei*, n. subsp.

KEY TO THE LARVAE

1. Siphon with 1 pair of hair tufts (*Aedes*).....2
Siphon with 3 or more pairs of hair tufts (*Culex*).....4
2. Comb teeth scalelike and arranged in a patch (Fig. 19).....*senyavinensis*, n. sp.
Comb teeth spinelike and arranged in a single line (Fig. 20).....3
3. Meso- and metathoracic pleural hair tufts each with a prominent basal spine; comb teeth with prominent lateral denticles (Fig. 20)... .....*aegypti* (*Linnaeus*)
Meso- and metathoracic pleural hair tufts not bearing a prominent basal spine; comb teeth with only a very fine basolateral fringe (Fig. 21).....*hakanssoni*, n. sp.
4. Siphon with six pairs of hair tufts (Fig. 24)... .....*annulirostris* Skuse
Siphon with not more than four pairs of hair tufts.....5
5. Siphon with 3 pairs of hair tufts, all in a line; siphon tapered from base (Fig. 23)..... .....*pullus maplei*, n. subsp.
Siphon with 4 pairs of hair tufts, third pair dorsally out of line to others; siphon tapered from about basal two-fifths (Fig. 22)..... .....*quinquefasciatus* Say

Aedes (Stegomyia) aegypti (Linnaeus)

Figs. 2, 14, 20

A medium-sized brown, or black, and white species; with a dark proboscis, all hind tarsal segments basally banded (V all white), vertex scales nearly all broad, numerous white pleural scale patches (not forming definite bands), and pale dorsobasal bands and separate lateral white spots on the tergites. The scutum is distinctively marked as follows: Two thin admedian longitudinal lines of narrow pale scales from near anterior margin to shortly before the prescutellar space, a small anteromedian spot of narrow pale scales, a rather broad crescent-shaped area of broad curved silvery scales on the lateral margin over *ppn* and along the scutal angle, a thin line of narrow white scales extending to the posterior margin from the end of the scutal angle, a patch of broad curved white scales before the wing base with a thin posterior extension above the wing base, and a line of narrow pale scales around the prescutellar space.

In general, the Ponape material showed the same range of variation common to *aegypti* elsewhere in its geographic range.

Bionomics.—The adults were not observed in nature. The larvae, which were taken only once, were collected from steel rain barrels.

Distribution.—Specimens examined (4 males, 5 females, 9 sets of adult-associated larval and pupal skins, 4 larvae): Greenwich Village, near Colonia.

Literature records for the Carolines: Ponape (Farner, 1944a). Kusaie, Truk Atoll: Moen I. (Bohart and Ingram, 1946).

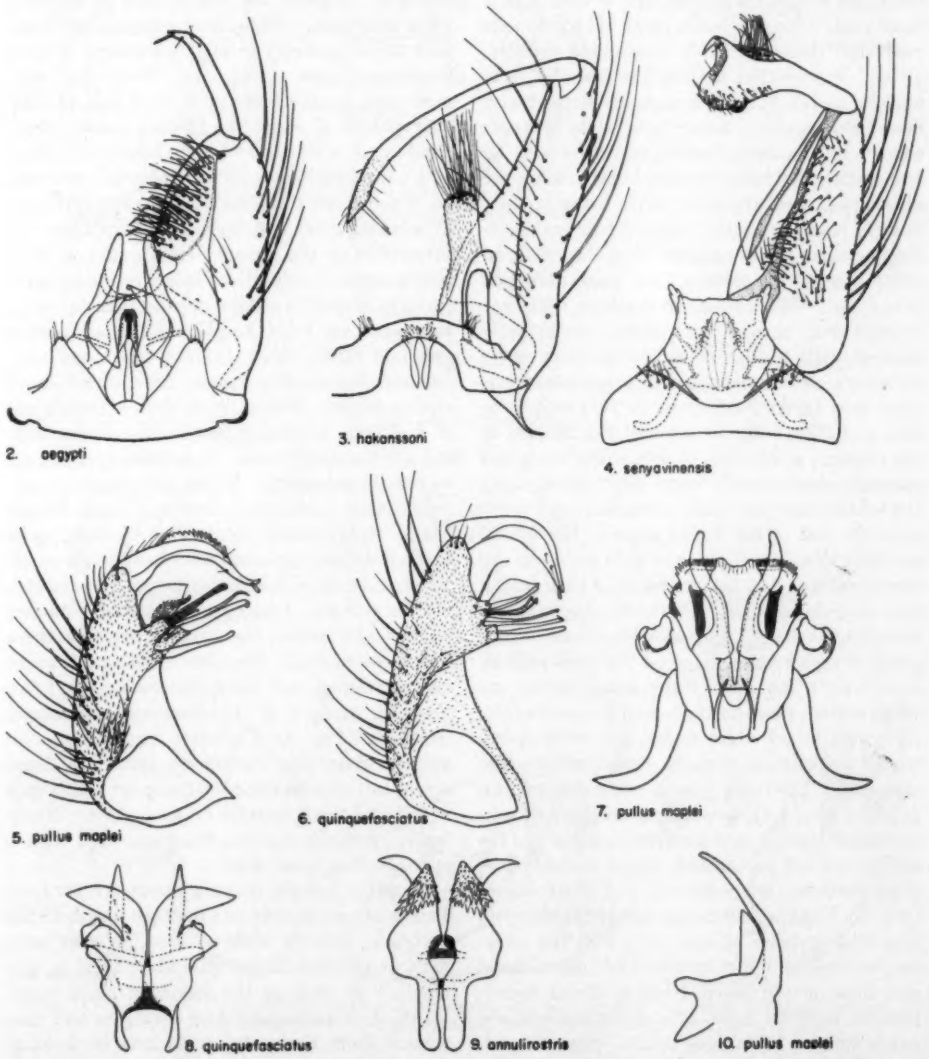
Systematics.—This species of *Stegomyia* was placed by Edwards (1932) in group A (*Stegomyia* s. str., or *aegypti*-group), which is a group composed of African species (undoubtedly the original home of *aegypti* also). The members of this group are distinct from all the Pacific species of *Stegomyia* in details of the scutal scale pattern, and in the possession of a prominent mesal-ventral arm basally on the tenth sternite.

Relation to disease.—This species is a proven vector of dengue elsewhere in the Pacific and is undoubtedly also the vector on Ponape. Epidemics of this disease occurred during the Japanese occupation of the Caroline Islands.

Aedes (Stegomyia) hakanssoni, n. sp.

Figs. 3, 11, 13, 16, 21

Adult.—A small black-and-white (the scutal pale markings yellowish) species; with a dark

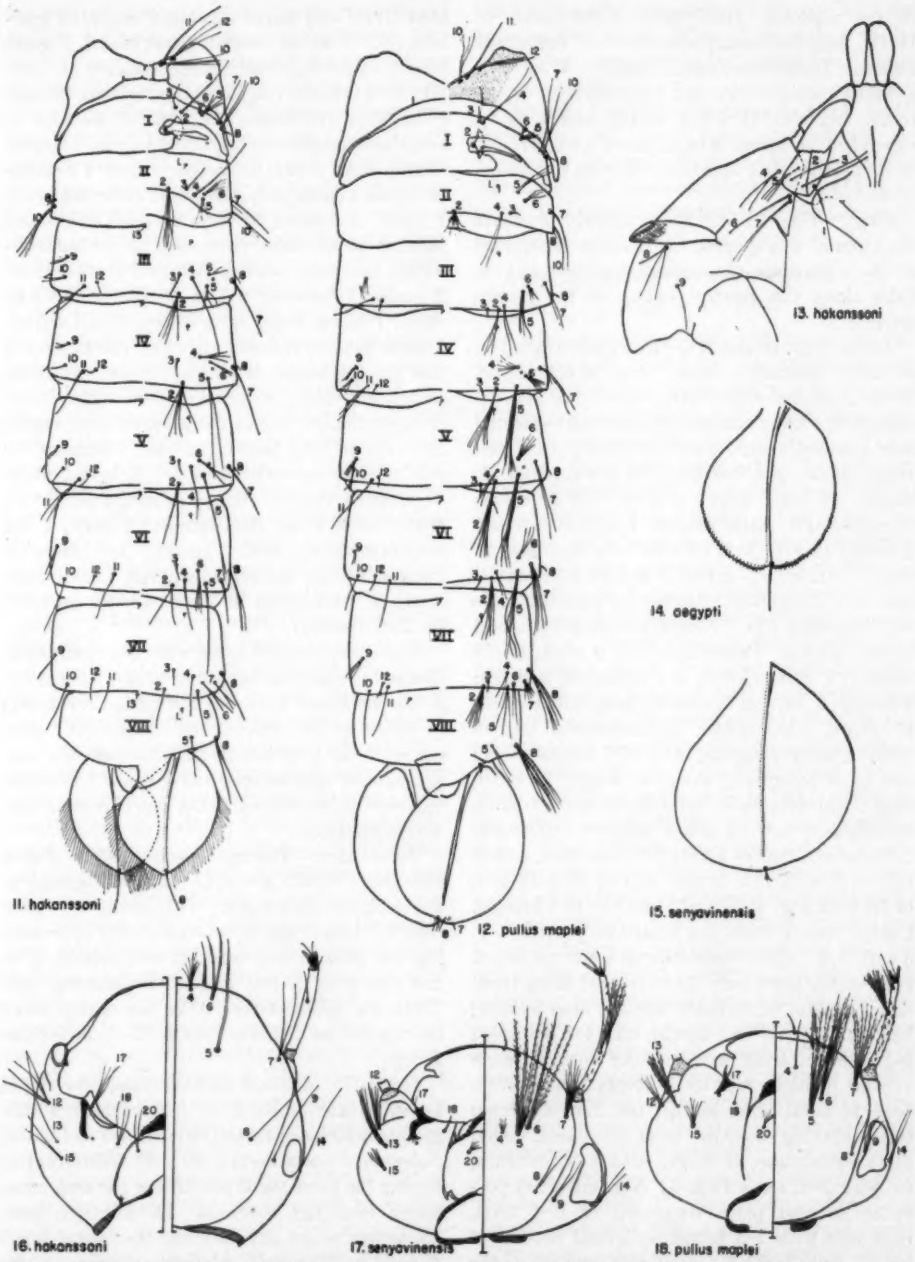


FIGS. 2–10.—Male genitalia: 2–4, Tergal aspect, left basistyle removed; 5, 6, mesal aspect of right basistyle; 7–9, sternal aspect of mesosome; 10, lateral aspect of right mesosomal lateral plate.

proboscis, all hind tarsal segments basally banded, vertex scales all broad, the white pleural scale patches forming two longitudinal bands across the pleuron, and prominent basolateral white spots on the tergites (becoming subbasal on the margins of the dorsum).

MALE: Length of wing about 2.0–2.5 mm. *Head:* Proboscis dark. Palpal length variable, ranging from somewhat shorter than proboscis to slightly longer; dark scaled, II with a white band just before the middle, III–V each with a basal white band, the bands on II–III incomplete ventrally, those on IV–V incomplete dorsally; IV and V somewhat upturned; a few stiff hairs apically on III–V. Torus partially clothed with broad white scales. Vertex with white or cream colored broad scales, broken on either side by two longitudinal bands of broad black scales, the alternating dark and pale bands being approximately equal in width; a line of pale scales extending along the eye margin from the subdorsal white area to the median line; some dark and pale upright forked scales on the nape. *Thorax:* Scutum with narrow black scales, prominently marked with whitish or yellowish-white scales as follows: A complete median longitudinal pale band that tapers posteriorly to the prescutellar area and there forks to the posterior margin of the scutum; a thin line of pale scales along the anterior scutal margin, over *ppn*, inward along the scutal angle and there extending posteriorly from the end of the scutal angle to the lateral scutellar lobe; and a patch of pale scales on the lateral margin just before the wing base with a thin posterior extension above the wing base; no acrostichal bristles. Scutellar lobes each with a patch of broad scales, those on the midlobe dark except for a few basal white scales (rarely no white scales), those on the lateral lobes all white. *Apn* with broad white scales; *ppn* with sparse narrow dark scales dorsally, broad white scales ventrally. Following pleural areas each with a patch of broad white scales: proepisternal, subspiracular (along the anterior margin of the sternopleuron), paratergite, dorsal sternopleural, mediposterior sternopleural, and mesepimeral (broadly V-shaped with apex directed anteriorly). The scale patches of *apn*, *ppn*, and the paratergite form an upper longitudinal pleural band and those of the proepisternum, dorsal sternopleuron, and the dorsal arm of the mesepimeral patch form a lower longitudinal pleural band. *Legs:* Forecoxa white scaled except for a median dark patch; mid coxa with white scales above and dark below, a few separate white scales dorsoposteriorly; hind coxa with white scales anteriorly, a small detached spot of white scales dorsoposteriorly. Fore and mid femora dark anteriorly except that in some cases a thin edging of white is visible along portions of the margins, prominently marked with pale scaling posteriorly. Hind femur white, with a dorsal dark area beginning subbasally or medially and widening across the anterior and posterior surfaces to just before the apex. Each of the femora with an anterior white knee spot. Tibiae dark, fore and mid with pale scales posteriorly, hind sometimes with a ventrobasal pale scaled area. Fore and mid tarsi with basal white scales on I and II, the pale spot on II consisting of only a few scales. Hind tarsus with basal white bands on I–V, that on I occupying about one-fourth of the segment, on II about one-third, on III about two-fifths, on IV a lateral patch only and varying from two- to three-fifths of the segment length, and on V a lateral patch varying from just a few basal pale scales to extending along one-half of the segment, the bands on I–III incomplete mesally. Fore and mid tarsal claws unequal, the larger unidentate, the smaller simple; hind tarsal claws equal, simple. *Wings:* Wing dark scaled; bases of fork cells approximately even; anterior fork cell approximately equal to its stem (may be up to one-third longer). Halter pale, knob largely pale scaled. *Abdomen:* Tergite I dark except for a white lateral band; II–VII dark, each marked with a prominent laterobasal white patch which extends subbasally just onto the margins of the dorsum, frequently scattered subbasal white scales across the dorsum between these dorsal extensions. Sternites with basal white bands, white scales along the midline and the posterior margins of the more basal segments. *Genitalia* (Fig. 3): Dististyle appendage subapical. Basal lobe prominent, bearing a dense apical tuft of long setae. Mesosome with about 6–8 strong teeth apically on each plate. Ninth tergite medially convex, the lobes each with a sparse tuft of small setae.

FEMALE: Length of wing about 2.7–2.9 mm. Palpus approximately one-fifth the length of the proboscis, broadly white at apex. Vertex as in male except that the median white band is only one-half as wide as the following black band. Portions of pale-scaled line over *ppn* and posteriorly from the scutal angle may be lacking. Scutellar lobes each with a patch of broad black scales, sometimes a few basal white scales present



FIGS. 11–18.—11, 12, Pupa: Metathorax and abdomen, left half ventral; 13, pupa: Cephalothorax; 14, 15, pupa: Dorsal aspect of the right paddle; 16–18, larva: Head, left half ventral.

on the midlobe. Hind tarsal basal bands of II–III may be basally complete on the mesal aspect. Tarsal claws equal, simple. Wing with a dorsal spot of white scales on the base of the costa. Sternite II white scaled except for a sub-apical or apical lateral black spot; III–VI white basally, dark apically; VII with a subbasal white band.

Pupa.—Figs. 11 and 13 completely illustrate the pupa of this species. It is easily recognized by the occurrence of a prominent fringe of long hairs along the greater portion of the paddle margins.

Larva (Figs. 16 and 21).—Description based on 10 adult-associated skins, from 6 collections. *Head:* Antennal shaft short, smooth, of approximately the same diameter throughout; antennal hair inserted about midway between base and apex, single, not reaching to apex. Hair 1, slender, pointed, single; 4 with 7–12 branches; 5 and 6 single, rarely double; 7 with 1–3; 8 and 9 single; 12 with 3–5; 13 with 1–2; 14 single; 15 with 1–3; 17 with 3–4; 18 and 20 with 2–4; ventral hairs well developed. Median mouthbrush hairs with comblike tips. Mentum with 9–13 lateral teeth. *Thorax:* Prothoracic hair 0 weak, thinly stellate; 1 slender, with 3–4 branches; 2 single; 3 double; 9, 10, and 12 slender, long, unbranched; 11 short, unbranched. Mesothoracic hair 9 large, greatly elongate, with 2–7 branches; 10 and 12 large, greatly elongate, single; 11 small, single. Metathoracic hairs 9, 10, and 11 as on mesothorax; hair 12 much reduced. *Abdomen:* Dorsolateral hair of I with 3–6 branches, lateral hair of I with 1–2; lateral hair of II with 2–6; of III with 2–4; of IV and V double; of VI single. Pentad hair 1 with 3–4 branches, 3 with 4–7, 5 with 3–4. Comb consisting of a curved row of 7–11 scales, these very finely fringed along basal half. Siphon dark, index 2.0–2.5; acus lacking; hair tuft at basal four-tenths, with 4–6 branches; 9–15 pecten teeth each usually with a single ventral denticle, the teeth evenly spaced from base to basal three-tenths, the line of pecten teeth curving dorsally from the base. Anal plate incomplete; *lh* large, with 2–3 branches; *isc* with 2–4; *osc* with 2–3. Ventral brush posterior to anal plate, composed of 6–8 tufts, each tuft with 1–3 branches, lateral portion of barred area lacking. Anal gills fingerlike, the dorsal pair slightly longer than the ventral pair and approximately 1.2–2.8 times as long as the anal plate.

Types.—HOLOTYPE: Male (5-1), with associated larval and pupal skins and mounted genitalia (U.S.N.M. no. 58806), Sokas Island, Ponape Island, Caroline Island Group, January 11, 1948 (H. S. Hurlbut), reared from a banana stump. PARATYPES (15 males, 31 females, 36 sets of adult-associated larval and pupal skins, 10 larval slides): Four males, 3 females, 7 sets of associated skins, 1 larval slide, same data as for holotype; 1 male, 5 females, 5 sets of adult-associated skins, 3 larval slides, same data as for holotype except that they were reared from glass bottles; 2 males, 7 females, 6 sets of adult-associated skins, 1 larval slide, Hydroplant, Not District, Ponape Island, January 15, 1948, reared from a tree hole; 2 males, 9 females, 8 sets of adult-associated skins, 4 larval slides, Palieij, Not District, Ponape Island, January 16, 1948, reared from a steel rain barrel; 5 males, 7 females, 10 sets of adult-associated skins, 1 larval slide, Matalanim Village, Ponape Island, January 21, 1948, reared from steel barrels; 1 male, 1 set adult-associated skins, Palieij, Not District, Ponape Island, January 16, 1948, reared from water in a canoe; all of the paratypes collected by H. S. Hurlbut.

Bionomics.—The females were not observed to bite man, either in nature or in the laboratory. A few specimens were seen resting in rain barrels in which larvae were living. The larvae were collected in tree holes, glass bottles, coconut shells, steel rain barrels, and a canoe. The larvae were quite common in the rain barrels around native dwellings.

Systematics.—This new species is a member of Edwards's (1932) group C (*scutellaris*-group) of the subgenus *Stegomyia*. That group was modified by Knight and Rozeboom (1946) by removing the *albolineatus* complex and raising it to the status of a full group. In keeping with Edward's nomenclature, this new group could be named as follows: Group E (*albolineatus*-group).

Group C, modified as mentioned above, can be subdivided into three rather distinct subgroups, which are tentatively defined as follows: *Subgroup I—scutellaris* s. str. Characterized by having the more mesal portions of the abdominal tergal markings subbasal. In addition, postspiracular scales are lacking, the scutal longitudinal median line is relatively slender, and the pleural scale patches are arranged in two rather well-defined longitudinal bands (not true of *gurneyi*, however). Included species: *alorensis* Bonne-Wepster and Brug, *andrewsi* Edwards,

guamensis Farner and Bohart, *gurneyi* Stone and Bohart, *hakanssoni*, n. sp., *hensilli* Farner, *horrescens* Edwards, *marshallensis* Stone and Bohart, *paullusi* Stone and Farner, *pernotatus* Farner and Bohart, *pseudoscutellaris* (Theobald), *quasiscutellaris* Farner and Bohart, *riversi* Bohart and Ingram, *scutellaris* (Walker), *scutoscriptus* Bohart and Ingram, and *tongae* Edwards. *Subgroup II—albopictus.* Characterized by the combination of the following: Abdominal tergal markings basal, no postspiracular scales, and the scutal longitudinal median line relatively slender. Included species: *albopictus* (Skuse), *cretinus* Edwards, *downsi* Bohart and Ingram, *flavopictus* Yamada, *galloisi* Yamada, *granti* Theobald, *novalbopictus* Barraud, *pseudalbopictus* Borel, *subalbopictus* Barraud, and (?) *unilineatus* (Theobald. *Subgroup III—mediopunctatus.* Characterized by the combination of the following: abdominal tergal markings basal, postspiracular scales present, and the scutal longitudinal median line quite broad. Included species: *mediopunctatus* Theobald, *m.* var. *submediopunctatus* Barraud, and *m.* var. *sureilensis* Barraud.

Aedes hakanssoni is most closely related to *scutoscriptus* Bohart and Ingram, a species that is known only from the Truk Atoll in the Caroline group. However, it is well distinct from *scutoscriptus* on both adult and larval characters. Both sexes of *scutoscriptus* have the scutellar lobes white scaled except for some apical black scales on the mid lobe, segment IV of the hind tarsus is all dark except for a few basal white scales, segment V of the hind tarsus is all white, and the basal bands of the hind tarsal segments are broadly interrupted mesally on I and V and narrowly so on III (complete on III in the male). Also, the lateral pale scaling that extends from the anterior margin to the scutal angle on the scutum is a solid, rather broad band in *scutoscriptus*. In *hakanssoni*, however, it is only a thin line of pale scales and with parts of it frequently obsolete altogether. The basal lobe of the male genitalia of *hakanssoni* differs distinctly from that of *scutoscriptus*, being quite similar to that of *riversi* and *hensilli*.

The larva of *scutoscriptus* is similar to that of *hakanssoni* except that head hair 6 is double, rarely single; the comb scales have a more developed lateral fringe, both dorsally and ventrally; *osc* is single (rarely divided, but not near the base); and the anal plate is more nearly complete.

Aedes hakanssoni is most easily distinguished from all the other members of subgroup I by the scutellar scaling, since they all have the scutellar scales white except for a few apical black scales on the midlobe.

This new species is dedicated to Capt. E. G. Hakansson, MC, U. S. Navy, Retired, who, as the former Medical Officer in Command of the Naval Medical Research Institute, so ably promoted this and numerous other mosquito investigations.

Aedes (Aedimorphus) senyavinensis, n. sp.

Figs. 4, 15, 17, 19

Adult.—A medium-sized dark brown species; with some pale scaling on the proboscis, dark tarsi, narrow dorsal vertex scales, 3 or 4 pleural patches of broad white scales, and basal pale bands on some tergites.

MALE: Length of wing about 2.6–2.9 mm. *Head:* Proboscis dark, frequently some ventral pale scaling at the medial joint. Palpus approximately equal in length to the proboscis, including the labella; dark scaled; apex of III slightly upturned, IV and V turned down; numerous long hairs ventrally on III, and ventrally and laterally along IV-V. Torus bare. Vertex dorsally with narrow scales, which are yellow except for a triangular median patch of dark scales just before the eye margin (the yellow scales extend to the midline along the eye margin), and dark upright forked scales; laterally with broad cream-colored scales, usually a patch of broad dark scales at the lateral margin of the dorsal narrow scaled area. *Thorax:* Scutal integument reddish brown; clothed with sparse hairlike black scales, a subdorsal patch of yellow scales extending posteriorly for a short distance from the anterior margin and a second patch on a longitudinal line with the first at the inner end of the scutal angle, also a few yellow scales medially on the anterior margin and a patch on the lateral margin just before the wing base. Each scutellar lobe with a patch of narrow black scales, usually a variable number of narrow yellow scales present basally. *Apn* with a few narrow yellow scales; *ppn* with sparse narrow dark scales, frequently a ventroposterior group of yellow scales present (may be some broadened scales in this group). Following pleural areas each with a small patch of broad white scales; dorsal sternopleural, medioposterior sternopleural, and dorsal mesepimeron. *Legs:* Forecoxa with dusky scales, mid and hind with some pale scales anteroventrally. Fore and mid femora dark scaled, prominently marked with

pale scaling posteriorly; hind femur anteriorly with a ventral white area beginning near apex and widening to base, posteriorly with ventral pale scaling. Tibiae with an apical pale patch, fore and mid tibiae paler posteriorly. Tarsi dark. Fore and mid tarsal claws unequal, all unidentate except the larger claw on the mid tarsus which is simple; hind tarsal claws equal, simple. *Wings:* Wing dark scaled; base of posterior fork cell nearer wing base than that of the anterior fork cell, anterior fork cell approximately equal to its stem in length. Halter knob with dusky scaling, paler apically. *Abdomen:* Tergite I dark scaled, a small pale scaled patch on the lateral margin; II with a few median pale scales, III-VI with pale basal bands that are widened laterally, VII with a pale vaso-lateral spot. Sternites with apical dark bands, VIII all pale scaled. *Genitalia* (fig. 4): Quite distinctive in the form of the dististyle and the mesosome.

FEMALE: Length of wing about 3.6–3.8 mm. Proboscis dark, a ventral and lateral paler area from near base to shortly beyond the middle. Palpus approximately one-sixth to one-seventh the length of the proboscis, dark scaled. Torus with a few dark scales mesally. Scutal scaling as in male except that sometimes a few yellow scales are present around the prescutellar space and rarely a thin line of pale scales posteriorly from the spot at the end of the scutal angle. Proepisternum with a patch of broad white scales. Tarsal claws equal; fore and mid claws each unidentate, hind simple. Anterior fork cell about one and one-half times its stem in length. Tergites dark dorsally, a rather indistinct basal pale band on IV and sometimes on V, sometimes also a variable number of basal pale scales on III and VI, a lateral pale band on I, and a basolateral pale patch on II–VII, VIII completely withdrawn, the cerci long and protruding.

Pupa (Fig. 15).—This pupa is rather similar to that of *hakanssoni*. However, it can be separated without trouble from either that species or *aegypti* by the poorly defined paddle margin.

Larva (Figs. 17 and 19).—Description based on 10 adult-associated skins, from one collection. *Head:* Antennal shaft long, curved, tapered uniformly from base, sparsely spiculate laterally; hair tuft inserted at basal two-fifths, with approximately 7–10 elongate frayed branches. Hair 1 long, slender, pointed, single; 4 with 4–7 branches; 5 with 3–6; 6 with 3; 7 with 5–9; 8 with 2–4; 9 with 2–3; 12 with 4–8; 13 with 4–6; 14 with 1–3; 15 with 4–9; 17 with 1–3; 18 with 1–2; 20 with 4–6; hairs 5, 6, and 7 long, well developed, frayed. Median mouthbrush hairs with comblike tips. Mentum with 14–17 lateral teeth. *Thorax:* Prothoracic hair 0 thinly stellate in form; 1 long, slender, single; 2 with 2 or 3 branches; 3 with 2–4; 9, 10, and 12 slender, single, rarely double; 11 small, with 2–6 branches. Mesothoracic hair 9 large, greatly elongate, with 3–7 branches; 10 and 12 large, greatly elongate, single; 11 minute, with 2–5 branches. Metathoracic hairs 9, 10, and 11 as on mesothorax; hair 12 much reduced. *Abdomen:* Dorso-lateral hair of I with 3–6 branches, lateral hair of I with 1–2; lateral hair of II with 1–7; of III–VI with 1–3. Pentad hair 1 with 5–8 branches, 3 with 8–14, 5 with 4–11. Comb consisting of a patch of 29–39 scales, each scale with lateral and apical fringe. Siphon light; maximum diameter at about the basal one-fourth, index about 3.2–3.3; acus present; hair tuft at distal one-third, with 3–5 branches; 16–20 pecten teeth, the distal tooth (and often the one just basal of it) more widely spaced and without denticles, remainder evenly spaced and each with a single ventral denticle, the pecten teeth extending from base to basal two-fifths. Anal plate incomplete; *lh* with 1–2 branches; *isc* with 8–13 branches; *osc* single. Ventral brush arising posterior and ventral to anal plate, composed of 12–13 tufts, each tuft with 6–12 branches. Anal gills tapered from near base, pointed, the dorsal pair slightly longer than the ventral and approximately 1.6–1.9 times as long as the anal plate.

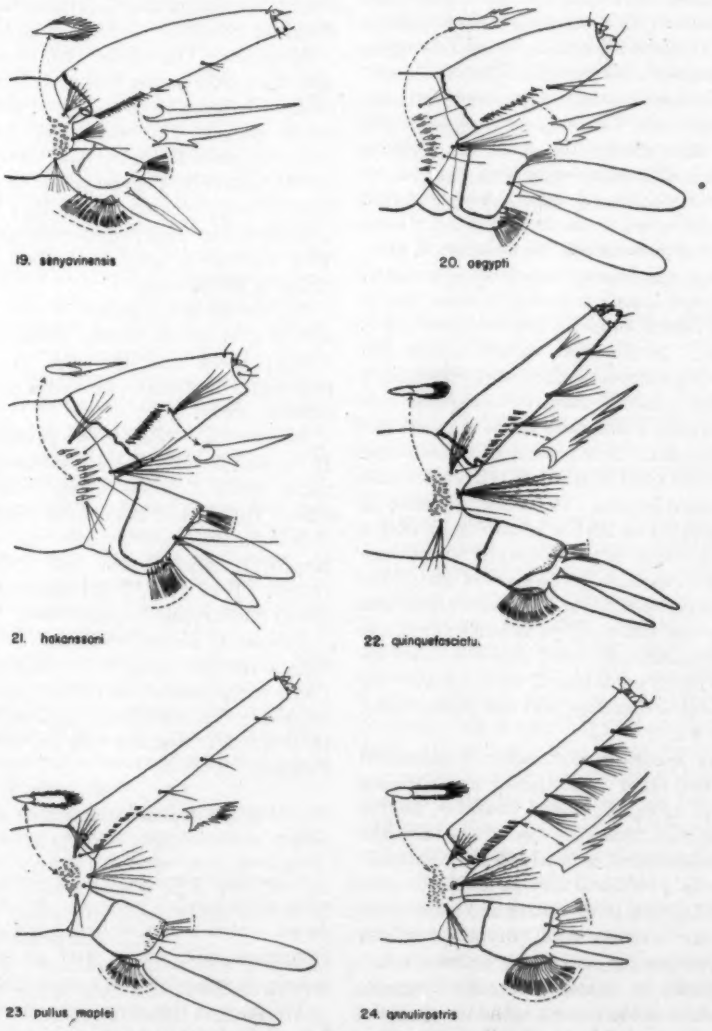
Types.—HOLOTYPE: Male (19–10), with associated larval and pupal skins and mounted genitalia (U. S. N. M. no. 58807), Rekisau, Not District, Ponape Island, Caroline Island Group, January 20, 1948 (H. S. Hurlbut), reared from the axils of young palms. PARATYPES: Eight males, 10 females, 15 sets of adult-associated larval and pupal skins, 4 larval slides, same data as for holotype; 1 female, with associated larval and pupal skins, 1 larval slide, Matalanim Village, Ponape Island, January 21, 1948 (H. S. Hurlbut), reared from steel rain barrel.

Bionomics.—The adults were not observed in nature except for one female taken in a trap baited with a live pig. The larvae were numerous in clear water collected in the axils of a group of young palms. In addition, one larval collection was made from a steel barrel containing rainwater.

Systematics.—This new species is most closely

related to the species included in Edward's (1932) group C (*alboscutellatus*-group: *Aedimorphus*) of the subgenus *Aedimorphus* but is excluded from the group by Edward's definition that the scutellar scales must be broad and silvery white. However, from the fact that *punctifemore* (Ludlow) and *oakleyi* Stone are also obviously related to the species included in group C and yet are excluded on the above scutellar scale character (in neither of these two species are the scutellar scales silvery white, although they are broad), it is evident that the coloration, and probably also the shape, of the scutellar scales constitute a character of less than group value and accordingly should be omitted from the group definition.

With the discard of the scutellar scale character, group D (*albocephalus*-group) is no longer sufficiently distinct from group C to justify its retention. Edwards (1932) supports this by saying that there is no sharp line of division between the two groups. Furthermore, in his 1941



FIGS. 19–24.—Larva: Terminal abdominal segments.

account of the Ethiopian members of the subgenus he goes so far as to redivide the African members of groups C and D into four divisions.

At any rate, until someone has an opportunity for making a new comparative study of all the species belonging to groups C and D, we prefer to treat them as a single group which we here tentatively designate as group C (*alboscutellatus-albocephalus* group). This group is separable from the others as follows: (1) Palpi of male as long as the proboscis, the last two segments noticeably hairy, and the ultimate segment not very short; and (2) the basistyle with basal lobe small or absent. Included species: *alboscutellatus* (Theobald), *culicinus* Edwards, *jamesi* (Edwards), *lowisi* (Theobald), *niveoscutella* (Theobald), *oakleyi* Stone, *orbitae* Edwards, *pampangensis* (Ludlow), *punctifemore* (Ludlow), and *senyavinensis*, n. sp. Unfortunately, the male of *ostentatio* (Leicester) is still unknown so that even its inclusion in the subgenus *Aedimorphus* is doubtful. Pending publication of a male description, the exact position of *wainwrighti* Baisas is also still uncertain but it is clearly not a member of group C.

Aedes senyavinensis is probably most closely related to *oakleyi* Stone, a species known only from Guam. In the adult, *oakleyi* is most distinct in having the scutellum covered with shining creamy broad scales. Also, *apn* possesses pale broad appressed scales, and the abdominal tergites of the female have prominent basal bands. In general, the adult of *oakleyi* is much paler than that of *senyavinensis*. The male genitalia of *oakleyi* is similar to that of *senyavinensis* except for the chaetotaxy of the dististyle, where some small differences occur. The larva of *oakleyi* has been described by Bohart and Ingram (1946) and from their description differs as follows from the larva of *senyavinensis:* head hair 6 double, the mentum with 18 or 19 lateral teeth, pentad hair 2 with about 3 branches, and the siphon index about 4.0–4.5.

This new species is most easily distinguished from all the other Australasian and Oriental members of group C, except *culicinus*, on the scutellar scaling, since all the others have the scutellar scales broad, or nearly all so. Although no specimens of *culicinus* were available for comparison, differences in the spines and hairs of the dististyle are evident from Barraud's (1934) figure. The larva of *culicinus* is undescribed.

This species is named after the Senyavin Islands, which is the eastern island group in the Carolines that includes the island of Ponape.

Culex (Culex) quinquefasciatus Say

Figs. 6, 8, 22

A medium-sized brown species; with dark proboscis and tarsi, narrow dorsal vertex scales, several pleural patches of broad white scales, and prominent basal creamy bands on tergites II–VII.

Although all the Ponape specimens examined came from only three larval collections, all the commonly reported adult and larval variations of *quinquefasciatus* were represented. No significant differences were noted between the Ponape specimens of *quinquefasciatus* and those described from other portions of its range.

Bionomics.—The adults were observed biting man soon after sunset and their biting activity continued through the night and early morning before sunrise. They were rarely found resting in native houses during the day. A few were seen near the entrance of caves; and a few were caught in a light trap, in a trap baited with a live pig, and in small wooden kegs placed under native houses. They were never taken in numbers except while biting in the evening.

The larvae were collected in water receptacles such as steel barrels, cement tanks, tin cans, and coconut shells near dwellings. In depositing their eggs, the females showed a preference for polluted water.

Distribution.—SPECIMENS EXAMINED (3 males, 17 females, 20 sets of adult-associated larval and pupal skins, 3 larval slides): Colonia, Sokas Island, Palikir, and Matalanim Village.

LITERATURE RECORDS FOR THE CAROLINES: Kusaie, Ponape, Woleai, and Palau (Farner, 1944a). Truk Atoll, Ulithi Atoll, and the Palau Group (Bohart and Ingram, 1946).

Relation to disease.—Filariasis is common on Ponape and this mosquito is probably the vector. Under experimental conditions, *quinquefasciatus* is capable of transmitting Japanese encephalitis. However, this disease is now known to occur in Ponape.

Culex (Culex) annulirostris Skuse

Figs. 9, 24

A medium-sized brown or blackish species; with white-banded proboscis and tarsi, narrow dorsal vertex scales, several pleural patches of broadened pale scales, and prominent basal creamy or yellowish bands on tergites II–VII.

The pupa of this species may be distinguished from that of either *quinquefasciatus* or *maplei* by

the number of branches possessed by hair 5 on abdominal segments IV–VI: hair 5 on segment IV with 5–8 branches (usually 5–6), on segment V with 2–3, and on VI double. The two terminal hairs on each paddle are approximately equal in length.

No significant differences were noted between the adults of *annulirostris* from Ponape and those described from other portions of its range, except, that, in general the scutal scaling (particularly of the female) is darker, the abdominal banding is yellower, and the pale spots of scales are largely lacking from the anterior aspect of the fore tibia.

Several minor differences in the larvae have been noted. Woodhill and Pasfield (1941) reported Australian material as having a siphon index of approximately 7.2, and the anal gills only 0.6–0.8 times the length of the anal plate. These observations are corroborated by Lee (1944), also from Australia. On the other hand, Cooling (1924) describes the siphon index of Australian material as about 5.0–5.5 (also described head hair 7 as having 11–12 branches); Buxton and Hopkins (1925) of Samoan material as about 5.1; and Bohart and Ingram (1946) of specimens from Truk as about 6. The siphon index of the Ponape material is 4.1–5.3 (head hair 7 with 6–9 branches). On the basis of these records, and from observations made by the senior author in the New Hebrides, it is apparent that there is a considerable range of natural variation in the siphon index of this species. From the literature records mentioned above it is also apparent that the anal gills are variable in length (1.5–2.0 times longer than the anal plate in Ponape material), but no correlation between this character and the geographical distribution of the species is possible at present.

Bionomics.—The females are commonly observed biting man soon after sunset, and their activity continued throughout the evening. They were captured in great numbers in a trap baited with a live pig, as many as 400 being taken in a single overnight catch.

The larvae were collected in clean water in ditches containing emergent vegetation, in small marshy areas containing algae and emergent vegetation, in shallow wells open to sunlight, in small cement tanks containing algae, and in a rock pool containing algae.

Distribution.—SPECIMENS EXAMINED (9 males, 16 females, 22 sets of adult-associated larval and pupal skins, 7 larvae): Colonia, Sokas Island, Matalanim Village, and Ronkiti.

LITERATURE RECORDS FOR THE CAROLINES: Truk Atoll and Ulithi Atoll (Bohart and Ingram, 1946).

Systematics.—Of the *Culex* (*Culex*) species with banded proboscis, *annulirostris* is probably most closely related to *sitiens* Wiedemann, from which it is distinct on characters of the male genitalia and of the larva. There are undoubtedly valid adult coloration differences, but since both species are subject to natural variations in the intensity of the color pattern (particularly of the scales of the vertex, scutum, and abdomen) these are rather unsafe for use until more comprehensive studies, covering all portions of the geographical range of the two species, are made.

Culex annulirostris marianae Bohart and Ingram, from the Marianas, is subspecifically distinct in possessing an apical line of pale scales on tergites II–IV, and sometimes also on V–VI. The anal gills are usually shorter, frequently much shorter, than the anal plate.

Culex (Culiciomyia) pullus maplei, n. subsp.

Figs. 5, 7, 10, 12, 18, 23

Adult.—A medium-sized brown species; with dark proboscis and tarsi, some broad dorsal vertex scales, and prominent basal creamy bands on tergites III–VII; and without scales on the pleuron. Pleuron pale, prominently marked by two longitudinal broad dark bands (integumental), the ventral one terminating medially on the sternopleuron.

MALE: Length of wing about 3.0 mm. *Head:* Proboscis dark, a prominent ventral tuft of bristles medially (just before the labial joint), numerous short hairs all along the proboscis. Palpus longer than the proboscis, including labella, by approximately the length of the last segment; dark scaled; II–III straight, usually directed obliquely away from the proboscis and IV–V directed obliquely inward toward the proboscis; III with a rather sparse ventral row of long modified scales from near base to apex, these modified scales hairlike except for being broadened and flattened medially, numerous long hairs ventrolaterally and mesally along IV–V. Torus bare. Vertex covered with broad creamy scales, dorsum with dusky upright forked scales (the more anterior ones paler) and with a band of narrow creamy scales on the nape and more sparsely on the longitudinal midline. *Thorax:* Scutum with fine brownish narrow scales. Scutellar lobe with pale narrow scales. *Apn* bare of

scales; *ppn* with some narrow brownish scales dorsally. No pleural scale patches. Single lower mesepimeral bristle present. Pleural integument pale; marked with a prominent longitudinal dark brown band beginning on *ppn* and txtending across the postspiracular, prealar (beeow the knob), and upper mesepimeral areas; and a second shorter one below, beginning on the proepisternum and extending about halfway across the medial portion of the sternopleuron. *Legs:* Forecoxa with dusky scales anteriorly; mid with a few dusky scales anteriorly; hind bare of scales. Fore and mid femora dark scaled, marked with pale scaling posteriorly; hind femur pale scaled, anteriorly with dark scaling dorsally from near base to apex, posteriorly the apical two-fifths is largely dusky. Tibiae and tarsi dark. Fore and mid tarsal claws unequal, each unidentate; hind tarsal claws equal, simple. *Wings:* Wing dark scaled; base of fork cells approximately even, anterior fork cell noticeably longer than stem. Halter knob with grayish scales. *Abdomen:* Tergite I with a median area of dark scales; II dark scaled; III–VII with broad basal creamy or yellowish bands, on the more posterior segments these bands are narrowed medially, all the bands extending onto the lateral aspect. Sternites II–III pale scaled, IV–VII with pale scales basally and dark scales apically. *Genitalia* (Figs. 5, 7, 10): Identical with that of *pullus*, the genitalia of which has been illustrated by King and Hoogstraal (1946). Their drawing of the basistyle of *pullus* is a lateral view and shows the distinctive hair tuft that is present at the level of the subapical lobes. This is also present in *maplei* but is not visible in the mesal view given in Fig. 5 of this paper. Their drawing of *pullus* fails to show one of the three appendages (the curled-tipped or shortest one) always possessed by the most distal-mesal lobe. This setalike appendage is difficult to locate unless stained. Also, the irregular subapical lateral lobe of the tenth sternite is omitted in their drawing.

FEMALE: Length of wing about 3.2–3.8 mm. Proboscis without a special hair tuft. Palpus approximately one-sixth the length of the proboscis, dark. Torus with dusky scales and hairs mesally. Vertex as in male except that the narrow scaled dorsal area is more extensive. Forked upright scales golden brown. Scutellar scales approximately the same shade of color as those of the scutum. Tarsal claws equal, simple. Stem of anterior fork cell only slightly more than one-half as long as the cell. Basal band on tergite VII frequently broken medially; tergite VIII dark. Sternite scales may be nearly all pale. Ocassionally a thin apical pale line of scales on some tergites. *Variations:* Two female specimens of the series studied completely lacked the basal band on tergite III.

Pupa (Fig. 12).—This pupa may be distinguished from that of the other two *Culex* species treated in this paper by the number of branches possessed by hair 5 on abdominal segments IV–VI: hair 5 on segment IV with 4 or 5 branches, on V with 3–6 (5–6 branched in 20 out of 22 examples), and on VI with 3–7 (usually 5–6, and with 3 branches only once out of 22 examples). It is also distinct in the lack of pigment on the lateral half, or more, of the metathorax. The two terminal hairs on each paddle are approximately equal in length.

Larva (Figs. 18, 23).—Description based on 10 adult-associated skins, from 4 collections. *Head:* Antennal shaft spiculate and somewhat broadened from base to level of hair tuft, slenderer and mostly free of spicules from there to apex; hair tuft inserted just before apical one-third, with approximately 15 elongate frayed branches; subapical bristles distinctly removed from apex. Hair 1 elongate, slender, single (once forked); 4 single; 5 with 4–7 branches; 6 with 3 or 4; 7 with 8–11; 8 with 2; 9 with 3–7; 12 with 3–5; 13 with 2–5; 14 with 1–3; 15 with 4–7; 17 and 18 single; 20 with 3–6; hairs 5, 6, and 7 prominently frayed. Median mouthbrush hairs with comblike tips. Mentum with 13–15 lateral teeth. *Thorax:* Prothoracic hair 0 thinly stellate in form; 1, 2, and 3 greatly elongate, single; hairs 9 and 10 slender, single; hair 11 small, with 4–7 branches; hair 12 large, greatly elongate, single. Mesothoracic hair 9 greatly elongate, with 4–5 branches; 10 and 12 large, greatly elongate, single; 11 minute, with 3–4. Metathoracic hairs 9, 10, and 11 (with 2–5 branches) as on mesothorax; hair 12 much reduced in length, slender, single. *Abdomen:* Dorsolateral hair of I with 2–4 branches, lateral hair of I double; lateral hair of II with 3 (once 4); of III–VI double. Pentad hair 1 with 5–7 branches, 3 with 6–8; 5 with 2–3. Comb consisting of a patch of approximately 32–37 scales, each scale with a complete lateral and apical fringe. Sipon pale; index 6.0–10.6; acus present; 3 hair tufts (once 4 on one side) present, the first inserted just beyond the most apical pecten tooth and the last near the apex, each with 2 or 3 branches (once single and once with 4); 8–15 pecten teeth, each tooth with a complete ventral

fringe of denticles. Anal plate complete; pale; with small denticles lateroposteriorly; *lh* single; *isc* single, *osc* single. Ventral brush composed of 8 tufts arising from a barred area posterior to the anal plate, each tuft with 3–6 branches. Anal gills somewhat fingerlike, the dorsal pair 2.0–2.6 times as long as the anal plate and just slightly longer than the ventral pair. *Variations:* A rather extensive range in the siphon index was the most important larval variation noted.

Types.—HOLOTYPE: Male (30–9), with associated larval and pupal skins and mounted genitalia (U. S. N. M. no. 58808), Sokas Island, Ponape Island, Caroline Island Group, January 27, 1948 (H. S. Hurlbut), reared from a taro axil. PARATYPES (13 males, 19 females, 31 sets of adult-associated larval and pupal skins, 5 larval slides): Seven males, 5 females, 11 sets of associated skins, 1 larval slide, same data as for holotype; 2 males, 7 females, 9 sets of associated skins, 1 larval slide, Colonia, Ponape Island, January 10, 1948, reared from a tin can; 1 female with associated skins, 2 larval slides, Palieij, Not District, Ponape Island, January 16, 1948, reared from a steel tub; 4 males, 6 females, 10 sets of associated skins, 1 larval slide, Matalanim Village, Ponape Island, Jan. 21, 1948, reared from steel barrels; all the paratypes collected by Hurlbut.

Bionomics.—The adults were not collected in nature. Caged females reared in the laboratory failed to take blood from a mouse during several overnight exposures, nor would they bite man. The larvae were very numerous in artificial containers around native dwellings, often being found in polluted water in tin cans and steel drums along with *quinquefasciatus*, and in cement tanks in the foundations of destroyed Japanese houses. Two larval collections were made from water collected in the leaf axils of taro plants. The egg rafts were easily distinguished from those of *quinquefasciatus* by their shape, the former being roughly circular in outline while the latter are elongate with pointed ends.

Systematics. The adult described above is well distinct from all of the known Pacific *Culiciomyia* species[4] except *pullus* Theobald. From this species it is distinguishable only in the larval stage. The larva of *pullus*, although definitely similar in general form, is distinct in having a transverse unsclerotized band in the siphon (also true of *nigropunctatus*). Fourteen larval specimens of *pullus* from Guadalcanal, Solomons; Hollandia, New Guinea; and Morotai, Moluccas disclosed the following additional differences from *maplei:* head hair 5 triple (once with 4 branches), and the lateral hair of abdominal segments III–VI single.

Because the differences between *pullus* and the Ponape species occur only in the larval stage, and because the two species are geographically separate, it was thought best to name the latter as a subspecies of the first.

Bohart and Ingram (1946) report a larval collection (no adults were obtained) from the Palau Group which could be either *pullus* or *nigropunctatus* (the larvae of the two being undistinguishable at present). This is the only other record of a *Culiciomyia* from the Caroline Islands. The range of *pullus* extends from the Solomons through New Guinea and Australia to the Moluccas, and that of *nigropunctatus* from the Celebes to India and the Philippines. These two species are well distinct from one another on male genitalic characters.

This new species is dedicated to Dr. John D. Maple, II, formerly of the Bureau of Entomology and Plant Quarantine, and of the U. S. Navy, who lost his life on April 11, 1945, while engaged in mosquito research duties on Okinawa.

[4] The following 14 species of *Culiciomyia* are at present recognized from the Pacific area: *bahri* Edwards, *bailyi* Barraud, *fragilis* Ludlow, *fuscicinctus* King and Hoogstraal, *javanensis* Bonne-Wepster, *nailoni* King and Hoogstraal, *nigropunctatus* Edwards, *pallidothorax* Theobald, *papuensis* (Taylor), *pullus* Theobald, *ryukyensis* Bohart, *shebbearei* Barraud, *spathifurca* Edwards, and *viridiventer* Giles.

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HERPETOLOGY.—*Miscellaneous notes on Mexican lizards.*[1]

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For a number of years I have been accumulating notes on lizards of Mexico for use in a report upon the collections secured from 1938 to 1940 by my wife and me during my tenure of the Walter Rathbone Bacon Traveling Scholarship of the Smithsonian Institution. Preparation of a checklist of Mexican lizards prior to completion of this report requires preliminary publication of certain portions of these notes.

Unless otherwise stated, the specimens cited in the following pages are part of the collections mentioned previously, now part of the U. S. National Museum collection, to which the numbers refer. Other abbreviations are: EHT-HMS, the Taylor-Smith collection, at the University of Kansas; CNHM, Chicago Natural History Museum.

I am indebted to Dr. Edward H. Taylor, Dr. Doris M. Cochran, Karl P. Schmidt, and Dr. L. C. Stuart for numerous courtesies contributing to the collection and study of the material here reported.

Sphaerodactylus glaucus glaucus Cope

One hundred and sixteen typical specimens (see below) were secured at the following localities: VERACRUZ: Tezonapa (no. 113086). TABASCO: Álvaro Obregón (Frontera) (nos. 113096–120); Emiliano Zapata (Montecristo) (no. 113095); Tenosique (nos. 113087–94). GUATEMALA: Piedras Negras, Petén (nos. 113084–5).

All except a few from Piedras Negras were caught in towns, under loose bark of trees or in houses. On May 13, 1939, large quantities of eggs nearly ready to hatch, as well as adults, were found under the loose flakes of bark on trees in the central park of Álvaro Obregón. Many of the eggs that were retained hatched within a day or two. Generally two eggs were found in a clutch, although sometimes as many as six or eight, presumably from several females, were found in a single spot. The eggs were nearly perfect spheres and were protected by a very brittle shell.

The adults of the east-coast race of this species are characterized by generally having a small black spot middorsally on the neck; a black spot on each side of rump, above insertion of hind leg, each bordered posteriorly by a light spot; a light spot on knees and sometimes elbows; a distinct, light band across distal portion of thighs and lower foreleg; and a distinct light line on posterior surface of thigh, extending onto base of tail.

Young specimens are similarly marked, although a little darker and with numerous very tiny white flecks scattered over the back. The only great difference from the adults in markings is in the neck region. A series of small rounded light spots encircles the dorsal and lateral surfaces of the neck a short distance in front of the arm insertion; the two most prominent spots are those on each side of the middorsal line. Surrounding the spots is an irregular band of black; its most prominent portion is a spot between and slightly anterior to the larger, paravertebral light spots. Specimens of larger size lose all these neck markings save the median dark spot.

A series of atypical specimens is available from various localities near Tehuantepec (La Presa de Mixtequilla, Cerro Guengola, Cajón de Piedra) as well as from the city itself (nos. 113139–63). These differ from typical *glaucus* by lacking any distinct light and dark marks in the adult; even the very young show no distinct markings. These might be considered racially distinct from *g. glaucus*, except for two adult specimens which possess an irregular, black, double collar about the neck. These definitely link the Tehuantepec series with the west-coast race *torquatus*, typical specimens of which are available from more remote localities on the Isthmus toward the coast west of Salina Cruz. The latter race also is

[1] Received September 3, 1948.

characterized by absence of the distinctive markings of *g. glaucus*, but adds a new character in the possession of two broad, distinct black collars about the neck. In the area in which they occur on the Isthmus, on the coast southwest of Tehuantepec, they exist to the almost total exclusion of the unicolor type which occurs around Tehuantepec city; in fact only two specimens of the latter were said to be collected with the collared specimens. Since the collared specimens possibly range rather widely on the Pacific coast northwest of the Isthmus, as indicated by the type locality of *torquatus* at "Mazatlán" (Sinaloa?); and since the unicolored or typical *glaucus* type of pattern rarely if ever occurs with the collared specimens, there is ample reason to hold the latter as racially distinct from the others. In fact, Taylor (Univ. Kansas Sci. Bull. **31:** 302–305. 1947) has already demonstrated the distinctness of *torquatus*.

The unicolored specimens from the vicinity of Tehuantepec are, I believe, essentially intergrades between typical *glaucus* and *g. torquatus;* certainly they are intermediate both geographically and in pattern; they lack the characteristic collar of *torquatus*, yet like it are practically unicolored otherwise, contrary to *glaucus* which has distinct leg and neck markings. If Peters's *inornatus* from "Mexico" actually belongs to *glaucus* and is not a *lineolatus* with incorrect locality data as suggested by Barbour (Mem. Mus. Comp. Zool. **48:** 240. 1921), it may be based on the unicolored intergrades between *g. glaucus* and *g. torquatus*, from the vicinity of Tehuantepec.

The U. S. National Museum has 20 others, as follows: CAMPECHE: Apazote (no. 47796). OAXACA: Juchitán (nos. 30235–8). TABASCO: Álvaro Obregón (nos. 37749–51, 46694, 81166). VERACRUZ: Coatzacoalcos River (nos. 61184–5); Tuxpan (no. 25215). YUCATÁN: Mérida (nos. 6572, 62995–6); Cozumel Island (no. 47644). INDEFINITE: "Mexico" (nos. 96108–10).

Sphaerodactylus glaucus torquatus Strauch

Twelve specimens are from Cajón de Piedra (nos. 113126–33) and El Limón (no. 113134), Oaxaca. Both localities are near the coast west of Salina Cruz.

Corythophanes percarinatus Duméril

A single specimen (no. 113171) is from Colonia Hidalgo, 8 kilometers north of La Esperanza, Chiapas. It differs from a single specimen available from "Guatemala" (no. 25217) by having a blunter snout, smaller temporals, head scales less strongly keeled posteriorly, and scales on shank and thigh much smaller. Further specimens will be necessary to show whether these differences are due to individual variation; that they might have little significance is shown by considerable individual variation in *cristatus*, in which the temporal, thigh and shank scales vary considerably in size.

The species has not previously been recorded from Mexico.

Ctenosaura similis (Gray)

Thirty-eight specimens were secured, at the following localities: CHIAPAS: Palenque (nos. 115310–7); Tonalá (nos. 115318–30); La Esperanza (nos. 115331–3). TABASCO: Tenosique (nos. 115306–9).

These specimens agree sufficiently well with the characters described by Bailey (Proc. U. S. Nat. Mus. **73** (12): 32–37, pls. 16–20. 1928) for this very distinct species. In addition to his observations it may be noted that in females the dark bands so characteristic of males are broken and frequently so dim as to be scarcely discernible. The pattern in these usually consists of numerous, scattered, short black lines. The head is mostly light in males as a rule, but regularly in females and rarely in males also the head is largely dark.

There are very obvious differences between the skulls of *similis* and those of *acanthura* and *pectinata*.

Other Mexican specimens in the U. S. National Museum number 34. They are from the following localities: VERACRUZ: Mirador (no. 6403). YUCATÁN: Merida (nos. 8220–1); Chichen-Itzá (nos. 47794, 47953–5, 47992–3); La Vega (no. 47564; Puerto Morelos (no. 47647); Mujeres Island (nos. 47559–63); Cozumel Island (nos. 13897–13900, 47565) "Yucatán" (nos. 24724–5, 24898). CHIAPAS: Palenque (no. 47593); Tonalá (nos. 46685, 46693). TABASCO: Montecristo (Emiliano Zapata) (nos. 47793, 47802). INDEFINITE: "Mexico" (nos. 11002–3); "Tehuantepec" (nos. 10286, 56782, 58499). Some of these were not listed by Bailey (*op. cit.*); others were associated with the wrong numbers, and the one from "Mirador," Veracruz, was associated by him with *acanthura*. It is definitely not the latter, since the tail spines are smaller, no two whorls of spines are separated from each other by a single row of small scales, the sides are barred

(juvenile female), and the distance from pineal spot to posterior margin of head is short. It is not necessarily certain that the specimen came from Mirador, but at least the existence of *similis* in the region of central Veracruz is demonstrated by adults from Tierra Colorada, near the city of Veracruz (EHT-HMS collection, see Smith, Kans. Univ. Sci. Bull., **22:** 139–140. 1935). The specimens labelled "Tehuantepec" (Dr. Spear and J. Hurter) do not necessarily imply the city of Tehuantepec, where the species apparently does not occur, but rather the Isthmus.

Ctenosaura acanthura (Shaw)

Only four specimens were secured, at Hda. La Clementina, 4 miles west of Forlón, Tamaulipas (no. 115259) and 10 miles east of San Juan de la Punta, Veracruz (no. 115260).

The museum has 27 other specimens, as follows: TAMAULIPAS: Tampico (nos. 36261–4, 36408, 36628, 36672, 36862–5, 37008, 37356). VERACRUZ: Panuco River, 80 miles above Tampico (nos. 26316, 26323, 26340–1); between Tampico and Veracruz (nos. 82181–3). OAXACA: Dondominguillo (no. 72737). INDEFINITE: "Mexico" (nos. 42145–6, 42842, 44179, 82184); "Tehuantepec" (no. 58498). Some of these were listed by Bailey (*op. cit.*); the others were omitted. However, Bailey included, in his list of *acanthura*, one *similis* from Veracruz (no. 6403) and several *pectinata* (*sensu lato*) from Isabel Island and the Tres Marías Islands, and from the states of Guerrero, Oaxaca, and Michoacán. The specimen labeled "Tehuantepec" (J. Hurter) almost certainly does not refer to Tehuantepec City, where intensive collecting in recent years has failed to verify its existence in the region, but rather to the Isthmus.

Why several west-coast *pectinata* were included by Bailey in *acanthura* is not readily apparent. Not a single one can be referred to that species; none of the adults are black; none have large spines on the tail; and none have the small scales between any pair of whorls of large scales reduced to a single row at any point. There is no reason whatever to believe that *acanthura* occurs on the Pacific coast, so far as indicated by specimens now in the National Museum. The species appears to be perfectly well defined and restricted to the Atlantic coast from the Isthmus of Tehuantepec north to central Tamaulipas. It occurs in the same general area as *similis*, but its range appears to overlap that of no other species.

Ctenosaura pectinata (Wiegmann)

Fifty-one specimens were secured, at the following localities: GUERRERO: Acapulco (no. 115274); Cacahuamilpa (nos. 115277–82); 20 km north of Mexcala (nos. 115275–6); Tierra Colorada (nos. 115261–73). MICHOACÁN: 4 km north of Apatzingán (nos. 115299–302); Parácuaro (no. 115298). MORELOS: 5 km south of Cuernavaca (nos. 115295–7); Puente de Ixtla (nos. 115303–5). OAXACA: Cerro Arenal (no. 115283); El Limón (no. 115294); Escurana (nos. 115292–3); San Bartolo (no. 115291); San Gerónimo Ixtepec (no. 115290); Santiago Lachiguiri; Tehuantepec (nos. 115284–9).

The Museum has 163 other specimens as follows: SINALOA: Mazatlán (nos. 7180–3, 47956–7); Culiacán (no. 70665). NAYARIT: Tres Marías Islands (nos. 14078, 72655–7); Maria Madre Island, Tres Marías (nos. 24623–30, 71634–5); Isabel Island (nos. 24631–3); Minimán (no. 51402); San Blas (nos. 51403–7, 65138, 76613–8); "Tepic" (no. 58753). JALISCO: Barranca Ibarra (nos. 18967, 18970, 19032); Guadalajara (nos. 24922–3); San Marcos (nos. 18968–9). COLIMA: Colima (nos. 12196, 24708–17, 24719–23, 24726, 30594–603, 31484, 58670, 63702–31, 63734–68); Manzanillo (no. 63701); Tonila (nos. 63732–3). MICHOACÁN: Sierra Madre (no. 12230; Uruapan (no. 10234). GUERRERO: Balsas (nos. 47919–20, 58137); Tlapa (no. 46860). MORELOS: 10 miles south of Cuernavaca (nos. 20168–72). PUEBLA: Piaxtla (no. 47729). OAXACA: Cuicatlan (nos. 46835, 47194); Guichicovi (no. 47933); Juchitán (no. 72738); Tehuantepec (nos. 7533–4, 30430). INDEFINITE: "Mexico" (nos. 31286, 83330).

The various specimens from the west coast of Mexico south of Sonora variously assigned by Bailey (*loc. cit.*) to *acanthura*, *brachylopha*, *brevirostris*, *parkeri*, and *pectinata* all belong, I believe, to a single species. All the specimens in the U. S. National Museum assigned by him to these various names have been examined, and I can see no justification whatever for segregating them into so many species. That his arrangement is highly artificial and not a natural one (i.e., of true species and subspecies) is made immediately obvious by the recognition of several "species" from single localities. *C. similis* and *acanthura* may occur in the same locality, but this is the only recognized instance in which two species of the same group have overlapping ranges, and even this is doubtful because of the considerable competition. But that *four* species (*parkeri*,

pectinata, *brachylopha*, *acanthura*), all of the same group, should inhabit such restricted areas as the Tres Marías Islands, is preposterous. There are other cases of several species cited by Bailey from single localities. The reason for such segregation without regard to geography and the natural history of the subject, is apparently due to the overemphasis of certain "key" characters which were assumed not to vary but which actually do, to a considerable degree. The five anatomical categories given the rank of species are:

1. "Median row of dorsal scales interrupted at sacrum."
   2. "First and second or first, second, and third whorls of spinous scales interspersed with three rows of small flat scales"..... *acanthura*
   2.′ "First, second, third, fourth, and fifth whorls of spinous scales interspersed with three rows of small flat scales"..... *brachylapha*
1.′ "Median row of dorsal scales enlarged and extending from nape to tail, without interruption at sacrum."
   3. "Head very short, rostrum conspicuously decurved"..... *brevirostris*
   3.′ "Head normal, rostrum not conspicuously decurved."
      4. "First six whorls of spinous scales of the tail separated from each other by four or more rows of small flat, smooth scales"..... *parkeri*
      4.′ "First five or six whorls of spinous scales separated from each other by three rows of smaller scales, the next five or six whorls being separated from each other by two rows of smaller, flat scales"..... *pectinata*

The first division is impractical. The character is of aid in separating certain species of the genus, but in the area in question specimens show both extremes and all intermediates. In 28 specimens from Guerrero and Morelos, 8 have the series of enlarged middorsals passing over the sacral region without interruption; in the others the series is narrowly interrupted by as few as two small scales, or broadly interrupted by as many as 20 small scales. In one of five specimens from Michoacán, the series is complete in one, interrupted by 9 to 16 scales in the others. In 15 specimens from Oaxaca, the sacral series is uninterrupted in four, and interrupted by one to 14 scales in the others. The variation is such that it seems impossible to believe that this criterion has any significance. There is no correlation of the variation with other scale characters or with color.

By literal adherence to the word in the second division, no west-coast specimens could be associated with *acanthura*, but by the same interpretation neither could true *acanthura*. In the latter species the tail spines are stronger, longer, and more erect; the small scales between at least one or more pairs of whorls of enlarged spines are rarely not reduced to one row; adults and subadults (both sexes) become black by a general darkening of the whole body (not by encroachment of black upon spots that remain light, as in *pectinata*); and the reduction to two rows of the small scales between the whorls of enlarged scales begins with the second or third pair. Specimens agreeing with these characters are not represented in those examined from the Pacific coast, and there is good reason to believe the species does not exist there.

The third division, separating *brevirostris*, does not seem to me to have any support whatever even in the material assigned by Bailey to the two categories. The heads of presumed "*brevirostris*" specimens are in no respect whatever, so far as I can see, shorter than those of *pectinata*. It is true that the two cotypes superficially appear to have short heads, but the snout of one obviously has been pushed in, while the other has a partly broken skull.

The last division, segregating *parkeri*, is the most nearly feasible of all, but even this, I believe, has no special significance. Three paratypes cited by Bailey are from "Tres Marías, Nayarit," which means the Tres Marías Islands, where Bailey also distinguished *pectinata*, *brachylopha*, and *acanthura*. There is no geographic sense whatever in the existence of such a species, so very close in all characters but one to the specimens secured in the same localities, in two so very different spots—Barranca Ibarra, Jalisco (just north of Guadalajara), and on the Tres Marías Islands. The Tres Marías specimens obviously represent nothing but variations of the single species that occur on the islands, and I regard the Barranca Ibarra specimens in the same light. It is noteworthy that Bailey did not associate with the latter another specimen (U.S.N.M. no. 19032) of the same series and with the same data. It is true, however, that all of the three Barranca Ibarra specimens have *parts* (in most cases the extra row is reduced a few scales on each side of the middorsal row) of a fourth row intercalated between the proximal whorls of enlarged spines, while the same character is occasional in its occurrence elsewhere.

Two specimens (from Guerrero and Oaxaca) have portions of a fourth row intercalated between the basal five whorls of spines; in two others (Oaxaca, Guerrero) it occurs between the first, second, and third whorls; in two others recorded the extra row occurs only between the first and second whorls. These data indicate that the Barranca Ibarra specimens may uniformly be provided with four rows between the proximal whorls of spines, and thus deserve a name; it is also possible that the three specimens do not give a fair representation of the local variation, which may well actually be the same as elsewhere. Against the recognition of a local race at Barranca Ibarra is the fact that *Ctenosaura* does not incline toward formation of such restricted populations. Its members otherwise have large geographic ranges representing major faunal areas.

The elimination of such a miscellany of supposed species on the Pacific coast makes very clear and reasonable the distribution of the species of *Ctenosaura* in Mexico. *C. hemilopha* occurs in Baja California and Sonora, and southward is replaced by *pectinata*, which occurs from central Sinaloa to the Isthmus of Tehuantepec. Beyond the Isthmus (toward Central America), on both coasts, *similis* occurs to the exclusion of all others of its group; it extends northward on the Atlantic coast to central Veracruz. Here it either overlaps or dovetails into the range of *acanthura*, which occurs from Oaxaca (Dondominguillo) northward to central Tamaulipas. The only conspicuous overlapping of ranges occurs between members of different groups; i.e., the species *clarki*, *quinquecarinata*, *erythromelas*, and *defensor* belong to quite a different group than the others; they are of different habitus, size and habits, and occur commonly over broad areas occupied by *acanthura* and its relatives.

Phrynosoma boucardii (Bocourt)

One fine example is from Zimapán, Hidalgo (no. 111370). The U. S. National Museum has no others of the species.

This specimen differs from *orbiculare*, which it closely resembles, in the large size of the postorbital, temporal and occipital spines, the feeble keels on the gular scales, and the nearly erect position of the occipital spines. It measures 79 mm from snout to vent; the frontal region is strongly concave, the superciliary regions elevated and terminating posteriorly in a relatively large spine measuring a maximum of about 3.5 mm. The occipital spines are 5.8 mm long (maximum), and their posterior edges make an angle of about 75° with the horizontal, while the temporal spines are at an angle much less than 45°. The temporal spines extend farther posterior than the occipital (because of their nearly horizontal position), and the posterior measures 5.7 mm (maximum). The posterior infralabials, the postaurals and the subpostaurals are conspicuously enlarged. The gulars are feebly keeled.

Sceloporus malachiticus acanthinus (Günther)

Thirty-one specimens are from La Esperanza, Las Nubes, Salto de Agua, Cruz de Piedra, Finca Juárez, Rancho Las Gradas, and La Magnolia, all in the vicinity of Escuintla, Chiapas (nos. 112112–40; EHT-HMS 17046–7).

The dorsals vary from 34 to 39 (except in two, noted below), average 36.7 (34, two; 35, four; 36, eight; 37, six; 38, four; 39, five); femoral pores 12 to 16, average 13.7 (12, nine; 13, sixteen; 14, seventeen; 15, twelve; 16, two); there are two canthals, but in seven the anterior is forced above the canthal ridge; the median frontonasal is in contact with the lateral frontonasal in all except one side of one, both sides of four; one or more supraoculars are in contact with the median head scales in all except on one side of one, on both sides of another; the supraoculars are partially split (small outer scales) in one; the lorilabials are reduced to one row below the subocular on one side in three, on both sides in two; there are 3 scales (minimum) from median frontonasal to rostral in twenty, 4 in seven.

The most interesting of this series are 12 from Finca Juárez. This locality is at 2,500 to 3,000 feet in elevation, as high as or higher than any other at which *acanthinus* was secured. Seven of these are more or less typical of the subspecies, while the other five show so many combinations of characters of *taeniocnemis* and *acanthinus* that they must be considered intergrades. Two of them have small outer supraoculars; three have the median frontonasal separated from the lateral frontonasals on both sides, and one specimen on one side; three have four scales from the median frontonasal to the rostral and one has five; one has the aberrant count of 42 dorsals and another has 45. None of these can be considered typical *taeniocnemis*, although all approach the sum character of that race in a varying number of respects. I can see no alternative to the conclusion that these represent intergrades, that *acanthinus* and *taeniocnemis* intergrade, and therefore that the former must be removed from

the *spinosus* group and placed in the *formosus* group.

All specimens were found on the trunks of large trees. They were very wary and seldom seen except when we were specifically hunting them.

In addition to these are six noteworthy specimens (EHT-HMS X5020–4) from La Gloria, Oaxaca. This locality is on the east side of the Isthmus of Tehuantepec, almost directly north of Niltepec, but in the moist, high forest on the Atlantic slope, at about 1,500 feet elevation. The specimens were collected by Thomas MacDougall on dead, burned tree trunks in open cornfields recently cleared from the forest. They have 35 to 40 dorsals (35, 36, 37, 40, 40); 10 to 13 femoral pores (10-10, 11-?, 11-11, 11-12, 11-12, 13-13); two canthals; median frontonasal separated from laterals; large supraoculars in a single row and not in contact with median head scales, sometimes the outer row represented by one or two small scales split from "inner" row; lorilabials in two complete rows below subocular; and 4 to 6 scales (minimum counts) from median frontonasal to rostral (4, 5, 5, 5, 5, 6). The only adult (a female) measures 83 mm snout to vent; the others are juveniles. The color above is gray (no trace of blue), with a row of brownish spots on either side of middorsum, each spot covering about three scales; a feebly indicated, black, dorsal nuchal collar, visible also on sides of gular region; in the adult female a faint indication of the characteristic, broad, short, dark, median borders of the lateral belly patches occurring in males of this group.

The proper allocation of the La Gloria series is not too obvious. The specimens can not be associated with *taeniocnemis*, since this is a highlands species with divided supraoculars, much blue in the coloration, smaller dorsals, more numerous femoral pores, and no distinct rows of large spots. They can not be associated with *salvini*, which also has more numerous dorsals and in addition a complete nuchal collar. Although the large supraoculars and larger dorsals are reminiscent of *acanthinus*, the latter race has large frontonasals in contact with each other, and the supraoculars generally in contact with the median head scales.

Because of the impossibility of association of the La Gloria specimens with typical members of other races in adjoining areas, they might be considered as representing still a different race. In support of this view are the peculiar, very small, rounded scales in the internasal area; rare specimens of *taeniocnemis* show a similar condition, but otherwise it is unique. However, it seems more probable to me that the La Gloria specimens represent intergrades between *acanthinus* and *salvini;* they combine the characters of these two races and show no peculiarities not existing in one race or the other, except for the small internasals as previously mentioned. La Gloria is also geographically intermediate between the known ranges of the two races. Therefore, until further specimens from other localities, especially in western Chiapas (both Atlantic and Pacific slopes), indicate otherwise, it appears best to consider the La Gloria specimens as intergrades between *acanthinus* and *salvini*.

Sceloporus malachiticus taeniocnemis Cope

Fifteen specimens (nos. 112141–54) were secured at an elevation of about 5,500 to 6,500 feet on Mount Ovando, near La Esperanza, Chiapas. The adults are greenish above, as are the *acanthinus*. The dorsals vary from 37 to 47, average 41 (37, one; 38, one; 39, three; 40, one; 41, three; 42, two; 44, two; 47, one); the femoral pores are 11 to 15, average 12.6 (11, one; 12, eleven; 13, nine; 14, two; 15, one); the canthals 2-2, the anterior forced above the canthal ridge on one side in one; the median frontonasal is in contact with the laterals on both sides of two, on one side in one; there are 3 to 5 scales from rostral to median frontonasal (3, four; 4, eight; 5, three); one or more supraoculars are in contact with the median head scales in two; the supraoculars are in a single row on one side of three, on both sides of two; there are two complete rows of lorilabials below subocular on one side in two, on both sides in three.

The type of *taeniocnemis* (U.S.N.M. no. 24768, "Guatemala", collected by H. Hague) is a juvenile measuring 39 mm snout to vent, with all the outer scales missing; dorsals 40; femoral pores 13 or 14; two distinct rows of supraoculars; median head scales much subdivided; 4 scales from median frontonasal to rostral; lateral frontonasals separated from median; two complete rows of lorilabials; canthals 2-2.

Through the courtesy of Dr. L. C. Stuart I have had the privilege of examining a series of 20 specimens from Finca Samac, near Cobán, Alta Verapaz, and 3 others from the vicinity of Nebaj, El Quiche, Guatemala, all collected by him. The former series may be considered topotypic, since Hague is known to have collected in Alta Verapaz, and since the type of *taeniocnemis*

agrees in detail with several young from Finca Samac. I can not distinguish these specimens from those from Mount Ovando by any character which can not be attributed to the influence of adjacent forms, or which to my mind is significant. The specimens from Guatemala never have single supraoculars nor a number of other variants which occur in the Mount Ovando series; however, their existence in the latter is almost certainly due to the influence of the closely associated race *acanthinus*, which *taeniocnemis* approaches in character toward the edge of its range. The only peculiarity I have discovered by which the Mount Ovando series differs from that from Guatemala is in the reduction in the former of the lorilabials to one row at some point below the subocular. I do not believe this difference sufficiently significant or well established to warrant an attempt to split *taeniocnemis;* if other minor differences should be discerned, the two populations are so alike, compared with other subspecies of *malachiticus*, that they can not in any circumstance be considered equivalent of *smaragdinus*, *salvini*, *acanthinus*, etc.

Other specimens which must be referred to *taeniocnemis* are three from Cobán, Guatemala (C.N.H.M. 20533, 21003; A.N.S.P. 11316); one from Teopisca (between San Cristóbal and Comitán), Chiapas (U.S.N.M. no. 47503); and three from Pinobete, 8,400–8,800 feet, Chiapas (U.S.N.M. nos. 47761–3). The race has a central distribution on the highlands to the west and north of the range of *smaragdinus*.

The latter subspecies includes specimens from the central plateau of Guatemala and its projections; they are characterized by small size, numerous dorsals (39 to 51), and a single canthal. Females measuring no more than 52 mm snout to vent contain young in the uteri.

Leiolopisma assatum assatum (Cope)

Fifty-five specimens were secured, all in the state of Chiapas in the vicinity of La Esperanza (La Esperanza, Cruz de Piedra, Salto de Agua, Rancho Las Gradas, La Magnolia, nos. 115204–39). The U. S. National Museum has in addition one other specimen from Huehuetán, Chiapas (no. 47758). In 52 counts, the rows of dorsals vary from 29 to 37 (29, two; 30, thirty-two; 31, two; 32, sixteen). In 49 counts, the dorsals from parietals to posterior margin of thighs are 65 to 77, average 71.0 (65, one; 66, one; 67, three; 68, three; 69, seven; 70, six; 71, eight; 72, five; 73, six; 74, four; 75, three; 76, one; 77, one).

This species was most frequently encountered on the ground in coffee groves. In the dry season, when the ground is covered with a thick layer of dry leaves and there are no low plants to obstruct vision, they were easily captured by walking slowly through the leaves and watching closely for their wriggling, scampering bodies as they scurried out from the leaves near at hand and dived under others a few feet away. It was necessary to fall on the lizards immediately as they appeared, as otherwise they hid in the leaves and were almost impossible to find.

Leiolopisma assatum taylori Oliver

Nineteen specimens referred to this race were collected: GUERRERO: Agua del Obispo (nos. 115240–1); Tierra Colorada (no. 115242). OAXACA: Matias Romero (nos. 115243–6). CHIAPAS: Tonalá (nos. 115247–58). In addition the U. S. National Museum has one from "Mexico" (no. 46866) and 13 from "Tehuantepec," Oaxaca (nos. 30101–7, 30109–13, 30170).

The single specimen without definite locality data has 24 scale rows. The three from Guerrero have 26 (two) and 28; the dorsals are 69 (two) and 72; two have a nuchal on both sides, and one has one on only one side. The four from Matías Romero have 26 and 28 (three) scale rows; the dorsals are 68, 71 and 72 (two); two have nuchals, but in one of these on one side only; the other two have no nuchals. In the thirteen from "Tehuantepec," the scale rows are 26 (two), 28 (ten) and 30 (one). In the 12 from Tonalá, the scale rows are 26 (one), 28 (six) and 30 (four); the dorsals 66 (two), 68 (one), 69 (three), 70 (one), 71 (one), 72 (one) and 73 (one); three have nuchals on both sides, one has one on one side, and the remainder (eight) have none. The closest approach to *a. assatum*, as might be expected, is shown by the southernmost specimens, from Tonalá, in which the scale row counts of *a. assatum* occur in 33 percent of the specimens. The dorsal scale counts of the two races blend over quite a large area, since even the Guerrero specimens are within the lower limits of the range of variation in typical *a. assatum*.

Leiolopisma gemmingeri (Cope)

Sixteen specimens were secured, as follows: OAXACA: 17 miles north of Niltepec, on south side of Sierra Madre, in pine forest at 3,500 feet elevation (nos. 115195–6); San José Manteca, 5 km from Yautepec (no. 115194); Tres Cruces (nos. 115188–93). VERACRUZ: Tequeyutepec

(nos. 115197–203). In addition the U. S. National Museum has four cotypes from Orizaba, Veracruz (no. 6331), one from Río Verde (Veracruz) (no. 32372), and one from an unknown locality ("Panama," J. Hurter) (no. 56976).

In 20 of these specimens (excluding no. 32372, not seen), the scale rows vary from 25 to 28 (25, one; 26, five; 27, two; 28, eleven); and the dorsals from 60 to 68 (60, one; 61, one; 62, eight; 63, two; 64, two; 65, one; 67, one; 68, three). The color pattern is constant, save that in the specimens from Tres Cruces and San José Manteca the only portion of the lateral dark stripes that is well defined is the extreme upper edge; in the others the stripe is very dark throughout most of its width.

Leiolopisma silvicolum Taylor

The U. S. National Museum has two specimens belonging to the recently described *Leiolopisma silvicolum* Taylor (Copeia, 1937, no. 1: 5–7), known previously only from the type locality near San José de Gracia, Veracruz. They are no. 12092, from "Mexico," and no. 47611, from Cuicatlán, Oaxaca. Both have 30 scale rows and the limbs strongly overlapping, as do the two types. The lateral dark stripe is poorly defined posteriorly.

Measurement	No. 12092	No. 47611
Snout to vent	44.5 mm	47.0 mm
Hind leg	18.4 mm	17.5 mm
Fore leg	11.0 mm	12.5 mm
Axilla to groin	23.0 mm	27.0 mm
Dorsals	68	64

Eumeces lynxe Wiegmann

Twenty-seven specimens were secured, at Durango, Hidalgo (nos. 113576–82); Pan de Olla, Veracruz (nos. 113583–600); and Cruz Blanca, Veracruz (no. 113601).

Four specimens (one from Hidalgo, three from Pan de Olla) have three supraoculars as is typical of the variant named *furcirostris;* in these, of course, the large anterior supraocular is in contact with the parietals. In 11 other specimens (2 from Hidalgo, 8 from Pan de Olla, 1 from Cruz Blanca) the largest (second) supraocular also touches the prefrontals as in *furcirostris*, but a small supraocular is present between the second supraocular and first superciliary. In two others (Hidalgo and Pan de Olla) the second supraocular contacts the prefrontal on one side, is narrowly separated on the other. In the remaining nine, the prefrontals are broadly or narrowly separated from the second supraocular.

The U. S. National Museum has one other specimen (no. 14605) from "Mexico."

Eumeces sumichrasti (Cope)

Ten specimens are from Piedras Negras, Guatemala (nos. 113609–12), Palenque, Chiapas (nos. 113613–5), and La Esperanza, Chiapas (nos. 113616–7).

The only difference apparent between the Pacific and Atlantic coast specimens is in the longer retention by the former of the juvenile stripes. An adult from La Esperanza measuring 75.4 mm from snout to vent still retains very distinct, dark-edged light stripes, while a specimen from Piedras Negras measuring 66.5 mm. snout to vent shows no trace of the median stripe and very faint evidence of the dorsolateral light stripes.

The scale rows about the middle of the body vary from 26 to 30 (26, one; 28, two; 30, four).

The Museum has one other, the type (no. 6601), from Potrero, Veracruz.

Cnemidophorus sackii sackii Wiegmann

Through the courtesy of Dr. Robert Mertens I have recently received two photographs of the single type of *Cnemidophorus sackii* Wiegmann. These were furnished through the kindness of Dr. Eisentraut, of the Zoological Museum in Berlin. He reports that the type bears the collection number 884.

Comparison of these photographs (Fig. 1) with those reproduced in Gadow's monograph (Proc. Zool. Soc. London, 1906: 277–375) reveals a remarkable similarity to some individuals of his race *C. mexicanus balsas*, and especially to specimen C of text figure 83. No other race closely approaches the type in details of pattern. It is of special interest to note the origin of specimen C; it is from Cuernavaca, Morelos, a city through which Deppe most certainly passed enroute from Mexico City to Acapulco (see Bailey, Proc. U. S. Nat. Mus. **73** (12): 5. 1928). Not unreasonably it may be supposed that the type of *C. sackii* actually was collected near Cuernavaca. Inasmuch as no *more* reasonable locality can be anticipated, I hereby restrict the type locality of *Cnemidophorus sackii* Wiegmann to Cuernavaca, Morelos.

The form recognized by Gadow as *C. mexicanus balsas* thus becomes a synonym of *C. sackii sackii*. A tentative arrangement of subspecies

will be proposed in the checklist of lizards now in preparation.

Bipes canaliculatus Lacépède

In 1932 Edward H. Taylor and I secured 15 specimens of this species, two of which were presented to the Museum of the Instituto de Biología in Mexico City, and one of which was prepared as a skeleton. All were taken in one small area near the Balsas River in Guerrero at the junction of the same with the Mexico-Acapulco highway. They were found under the large, weathered, sandstone rocks characteristic of the slopes exposed by erosion of arroyos and larger streams. Fortunately, the collecting followed a rather heavy shower, which, as the region is semiarid and very barren, evidently is of no frequent occurrence. The surface of the ground was quite dry even after a day's exposure to the sun, but under the larger, coarse stones the soil remained moist, and here, especially under those stones at the base of trees and bushes, were the lizards found. Frequently they had made long, winding burrows in the soil just under the rocks, and occasionally one would be found with only a small portion of the body above the ground and in contact with the lower surfaces of the rocks. The burrows were so characteristic that in many cases it could be observed that the lizards had at some time been present under rocks where none were then to be found. Presumably these creatures follow the level of moisture, and if it is raised to the surface or near it by a heavy shower, they should then be found under rocks more frequently than at any other time. During the dry season it is probable that only rarely would they be found in the upper, dry soil strata, except perhaps at night. Attempts to find them at night above ground were futile; in fact, one specimen was found under a rock at night. A local farmer said he occasionally plowed them up in his field, located in the flood plain of a stream entering the Río Balsas.

The intestinal contents of several specimens consisted largely of the elytrae and legs of Coleoptera.

When crawling about in the hands, the forelegs were frequently if not usually kept in active use, especially when the animals attempted to burrow or pry through small openings.

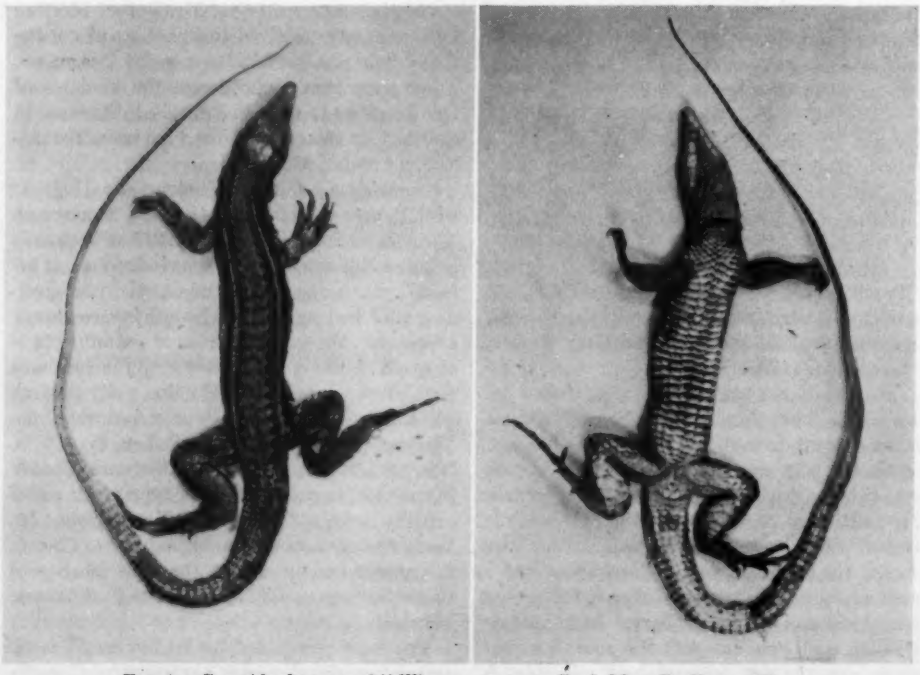


FIG. 1.—*Cnemidophorus sackii* Wiegmann, type, Zool. Mus. Berlin no. 884.

Cope (1898) placed his *Bipes biporus* in the monotypic genus *Euchirotes*, distinguishing the two genera (*Bipes* and *Euchirotes*) largely on the basis of the presence of a claw on the fifth digit of *Euchirotes*, the absence in *Bipes*. In two of our specimens, these claws are distinctly present, although small, and thus the character previously considered of generic value is shown to be even specifically variable. *B. biporus*, however, remains distinct from *canaliculatus* on the basis of other characters.

The following table gives general features of scalation and proportion:

VARIATION IN BIPES CANALICULATUS

No.	Ventral annuli on body	Ventral annuli on tail	Dorsal annuli	Pre-anal pores	Snout to vent	Tail	Head to occiput
					Mm	*Mm*	*Mm*
795	154	32+	197	6	158.8	24.0	8.0
966	154	29+	195	6	166.5	26.4	7.5
968	152	30+	194	6	166.5	24.8	8.0
969	149	30+	199	6	167.0	25.4	8.0
799	163	34+	200	6	170.0	27.0	8.0
800	152	32+	198	6	180.0	26.8	8.0
967	153	—	195	6	180.7	—	8.1
798	158	32+	199	6	181.0	28.0	8.0
797	162	—	198	6	185.0	—	8.2
964	156	32	200	6	190.0	29.0	8.0
796	155	—	196	6	192.0	—	8.3
965	164	35+	201	6	192.0	30.1	8.0

Two small frontals; a very large prefrontal; a large rostral; two nasals, somewhat smaller than rostral, nostrils perforating them nearer anterior edge; two large upper and two large lower labials, followed in each case by two smaller labials scarcely or no larger than scales of temporal region; eye in an ocular scale surrounded by a single preocular, two suboculars, and bordered posteriorly by two other small scales, all subequal; a large mental, smaller than rostral, and bordered posteriorly by another scale somewhat smaller, this in turn bordered on each side by a scale somewhat smaller and in contact with lower labials; dorsal annuli separated from ventral annuli very abruptly on a lateral line on each side; dorsal surface of limbs with about 6 annuli; digits 2–4 with 3 dorsal, 4 ventral scales, first digits with 2 dorsal, 3 ventral scales; a short gular fold between and in front of arms; latter 5–6 mm long in our specimens.

Color in life, uniform light brown above, lighter between annuli and between scales forming annuli; head in front of eyes, brownish cream, ventral surfaces pink, lighter to white posteriorly, limbs especially pink.

But little variation obtains in the scutellation of head, quite uniform in all except one in which on each side is a minute scale against the nasal between the second upper labial and preocular, another in which the left supraocular of each side is partially fused with the prefrontal, and another in which the right frontal was broken up into small scales, possibly due to injury.

Xenosaurus rackhami Stuart

A single specimen (no. 111524) of this species, of which only the type from Guatemala has previously been described, was presented me by Sr. Rafael Martín del Campo, of the Instituto de Biología in Mexico City. It was collected by Mario del Toro Áviles at Santa Rosa, near Comitán, Chiapas, during the summer (June to August) of 1937.

It agrees with the description of *rackhami* in the relatively large size of the gular scales, close approximation of the enlarged tubercles on the forearm, and the broad, low character of the tubercles on the body. I count 34 transverse rows of abdominal scales from axilla to groin. The species' most distinctive feature is the large size of the gular scales.

HERPETOLOGY.—*The validity of relative head width in defining the races of* Ambystoma macrodactylum.[1] M. B. MITTLEMAN, New Rochelle, N. Y. (Communicated by HERBERT FRIEDMANN.)

In a recent paper (1948) I presented the results of an investigation into certain aspects of the morphological variation of the salamander *Ambystoma macrodactylum*. Although several characters were studied, only three were found to display any variation significantly associated with geographic origin. These important variables are: Vomerine tooth counts, proportion of head width to head length, and proportion of head width to snout-vent length. The variations of these three characters are associated with certain geographic populations of *Ambystoma macrodactylum*, such that when the definitive range of variation for

[1] Received October 20, 1948.

each character is calculated for specimens from each of two general geographic areas in the over-all distribution of the species (*sensu lato*), it is possible to identify not less than 71 per cent of more than 300 specimens as to geographic origin, on the basis of any one of these discrete variables. Taken collectively, the three criteria together with certain color and pattern differences, will correctly identify the provenance of at least 85 per cent of the specimens seen in the course of this study.

In view of the highly significant association between these criteria and certain geographic populations, two races of *Ambystoma macrodactylum* were recognized: the typical form, *A. macrodactylum macrodactylum* Baird, occupying the Columbia Plateaus Province and the Northern Basin and Range Province in Washington and Oregon, and extending through the Cascade-Sierra Province from northern California to southern and western British Columbia; also a race, *A. macrodactylum krausei* Peters, occupying the Northern Rocky Mountains Province in Idaho and Montana, southwestern Alberta, eastern and northern British Columbia, and questionably extending east to Iowa.

In studying the relative head widths of the various samples used in this investigation, it was found that the ratio of head width to snout-vent length (hereafter called *HW/SV* ratio) provided a useful index to proportionate head width. However, two major types of variation were at once discernible: ontogenetic and geographic. It was found that when eastern and western specimens of equal snout-vent length were compared, eastern specimens tended usually to have proportionately narrower heads (lower *HW/SV* ratio) than did western specimens (higher *HW/SV* ratio). Despite the fact that this difference in *HW/SV* ratio between strictly comparable specimens provided a useful dichotomous character for discriminating between eastern and western specimens, its use was complicated by virtue of the fact that a prominent intra-population ontogenetic variation in the *HW/SV* ratio was present simultaneously. In brief, it was not possible to distinguish between the eastern and western populations merely by stating that population "X" had an *HW/SV* ratio of so much or more, while population "Y" had an *HW/SV* ratio of so-and-so or less, since the ratio itself changes very drastically as the animal grows and matures beyond the post-metamorphic stage.

The *HW/SV* ratio gradually diminishes from about 20 per cent in young, recently metamorphosed animals, to about 15 per cent in fully mature specimens, thus indicating that the head becomes progressively narrower relative to the snout-vent length as the animal grows in size.

Hence, in order to utilize dichotomously the differential in *HW/SV* ratio which was found in comparable specimens of the eastern and western populations, it was necessary to employ some device which would distinguish between the two populations, regardless of the size of the specimen(s) involved, and thereby circumvent the intrapopulation ontogenetic trend. The simplest solution to the problem was the utilization of a formulary device, based on the independent variable (snout-vent length), which could be applied to any snout-vent length and produce a fixed mathematical value. With such a value available, a dichotomous character results, for it is then possible to say that for any given snout-vent length population "X" has an *HW/SV* ratio (or head width) greater than the computed formulary value, while population "Y" has an *HW/SV* ratio (or head width) less than the formulary value. Such a formula was computed for comparing raw head width measurements, and another, derivative formula was likewise developed for comparing relative head widths (*HW/SV* ratios). These two formulas are respectively:

$$(2 \log SV)^2 - (\log SV)^2 \qquad (1)$$

$$\frac{(2 \log SV)^2 - (\log SV)^2}{SV} \qquad (2)$$

The application of the first formula to any particular snout-vent length results in a mathematical value which may be conveniently visualized as the "standard" head width for that snout-vent length. The application of the second formula to a given snout-vent length produces a value which may be considered the "standard" *HW/SV* ratio for that snout-vent length. In eastern

specimens (*A. m. krausei*), the head width and the *HW/SV* ratio are usually less than the value obtained from either of the two formulas, while in western specimens (*A. m. macrodactylum*) the head width and the *HW/SV* ratio tend to be higher than the formulary values. The formulas produce about the same degree of satisfactory separation of the two populations. In my original paper (*op. cit.*) I published a graph based on the first formula used in conjunction with 86 specimens equally divided between the eastern and western populations. That the formula is a satisfactory dichotomous device, and that the two populations have significantly different head widths when strictly comparable specimens are examined, is reflected in the fact that 61 out of the 86 specimens used (= 71 per cent) in preparing the graph are correctly separated by the curve computed from the formula. When this result is tested by chi-square to determine if it could have been fortuitous or resulted from a significant association between head width size and geographic origin, a chi-square value of 17.7 is obtained, indicating a highly significant association between the variable (head width) and geographic origin.

More recently, Joshua L. Baily, Jr., has reviewed my study of *Ambystoma macrodactylum*, with especial attention to the problem of the significance of the differences existing between the head widths of eastern and western specimens. Mr. Baily's paper includes an excellent discussion of some properties of the arithmetic mean, and of another average, the trigonometric mean, but does not appear to contribute in any way to the problem at hand. Baily states in the beginning of his paper (1948, p. 171) that he is inclined to question whether my material adequately demonstrates a real difference in head width in the salamanders under discussion, but in the conclusion of his paper (p. 174) Baily says that confirmation is given to my conclusion that Idaho specimens have narrower heads than do specimens from Oregon and Washington, subject to certain limitations.

Baily has attacked the problem of determining whether a significant head width difference exists between these two populations through the medium of comparing certain means, and the differences between these means. His results show that there exists a significant difference between the means of the *HW/SV* ratios of the two populations, whether the arithmetic mean or the trigonometric mean is used. However, although Baily's results confirm my original contention, his use of means to investigate the problem is open to serious question. When organisms display a strong ontogenetic variation in certain structural characters, as do these salamanders, the comparison of means based on these characters and predicated on random samples seems to me to be essentially meaningless. To have any true biological and statistical significance, such means must properly be based on equal numbers of specimens of each of the two populations or samples, for any given size class. Baily drew his data from the graph published in my original paper (*loc. cit.*), but it will be noted that the 43 Idaho specimens used in preparing this graph range from 41 to 59 mm in snout-vent length, while the 43 Oregon and Washington specimens vary from 40 to 68 mm, with not less than 10 out of the 43 western specimens being 60 mm$^+$ in length. As I have pointed out, the tendency in these ambystomids is to develop a proportionately narrower head as the snout-vent length increases. Hence, with 23 per cent of the Oregon-Washington sample of greater length than any available Idaho specimens (of those used in preparing the graph), means of the *HW/SV* ratios of these two samples would be biased toward a relatively lower figure for the western (Oregon-Washington) specimens than that obtained for the eastern (Idaho) specimens, and hence the difference between these means would tend to diminish. That the difference between these means is still significant, as Baily found, is strong confirmation of the real difference in head width in these two populations. Had there been Idaho specimens in the 60–68 mm range, the difference would probably have been even greater, as it would likewise have been if the Oregon-Washington specimens in the 60–80 mm range had been deleted from Baily's computations; with strictly comparable numbers of specimens from each of the two samples available for each size class, the

difference would have been still greater. In any event, a far better procedure for the determination of the significance of the difference in head width in these two populations would be to use a test such as the chi-square, or the standard error of the difference between the regression coefficients (of the head width—snout-vent regression of each sample).

In his conclusion, Baily states that my original finding respecting the difference in head width is confirmed "subject to limitations hereinbefore noted." The only possibly pertinent limitation Baily has noted, is that in my original paper I stated that the populations representing the races *krausei* and *macrodactylum* are homogeneous *intra se*, whereas Baily says that despite significant differences in the head widths of the two samples there may be local races of *macrodactylum* which do not differ from the Idaho (*krausei*) population in the same manner as the samples from Oregon and Washington which were used in this study. This is of course a distinct possibility; however, in the course of my investigation numerous intrapopulational comparisons of various criteria were made, and in no instance did the results suggest any other conclusion but that *krausei* and *macrodactylum* are composed of homogeneous populations, as defined in my paper.

In closing his paper, Baily points out what appears to be a *lapsus* on my part, in that the formula used in my graph is amenable to simplification, and can be reduced to—

$$\frac{6 \log (SV)}{SV}$$

However, this is the formula for a ratio, whereas the formula used in my graph is that of a simple equation. Baily goes on to state that my formula produces a "standard" head width—which is correct so far as the formula used for the graph is concerned. But obviously, in presenting his apparently simpler formula, he has reference to the second of my two formulas given above, which yields a "standard" *HW/SV* ratio, not a "standard" head width. In any event, Baily's formula produces an arithmetic result completely incompatible with either of my formulas, and the value obtained has no pertinency in the present problem.

Despite Baily's contentions to the contrary, the apparently straight line in my graph is a portion of a curve, and this curve passes through the common origin of both the *HW* and *SV* scales, if the graph is expanded so that both the abscissa and ordinate scales start at zero values. This curve is not asymptotic, as Baily maintains, since a zero value of *SV* will produce a zero formulary value, thus causing the curve to pass through the common origin of both scales of the graph.

SUMMARY

1. The problem of the dichotomous utilization of an ontogenetic variable, specifically the *HW/SV* ratio in *Ambystoma macrodactylum*, is discussed. The significant difference in the head widths of specimens of comparable snout-vent lengths of *A. m. krausei* and *A. m. macrodactylum* is reaffirmed, as is also the usefulness of the formula $(2 \log SV)^2 - (\log SV)^2$ in defining dichotomously the head widths of specimens of any snout-vent length.

2. Joshua L. Baily's use of various means to analyse the differences in head widths of *A. m. krausei* and *A. m. macrodactylum* is discussed, and the limitations involved in the use of means predicated on ontogenetically-variable ratios are pointed out.

3. Baily's contention of a *lapsus* in my original paper is refuted, his confusion of two formulas is pointed out, and it is noted that my curve is non-asymptotic, and that the formula from which it is derived is not amenable to further simplification.

LITERATURE CITED

BAILY, JOSHUA L., JR. *Supplementary observations on the geographic variation of* Ambystoma macrodactylum. Herpetologica **4**: 171–174. 1948.

MITTLEMAN, M. B. *American Caudata: II, Geographic variation in* Ambystoma macrodactylum. Herpetologica **4**: 81–95, fig. 1. 1948.

PROCEEDINGS OF THE ACADEMY

421ST MEETING OF BOARD OF MANAGERS

The 421st meeting of the Board of Managers, held in the Cosmos Club, October 18, 1948, was called to order at 8:05 P.M. by the President, Dr. F. D. ROSSINI. Others present were: W. L. SCHMITT, F. G. BRICKWEDDE, W. W. DIEHL, F. M. DEFANDORF, W. N. FENTON, WALTER RAMBERG, T. DALE STEWART, C. F. W. MUESEBECK, W. W. RUBEY, F. O. COE, M. A. MASON, H. G. DORSEY, C. L. GAZIN, and, by invitation, R. J. SEEGER, ALAN STONE, and FRANK THONE.

The chairman of the Committee on Meetings, Dr. RAYMOND J. SEEGER, announced that Dr. TRYTTEN, of the National Research Council, had been secured as speaker for the October meeting of the Academy and that he would talk on *Scientific personnel problems of today*. He also announced that Dr. BACHER, of the Atomic Energy Commission, would speak on atomic-energy research at the November meeting.

Five persons were elected to resident membership and one to nonresident membership.

The chairman of the Special Committee on the Encouragement of Science Talent in the schools of the Washington area, Dr. MARTIN A. MASON, presented the following report:

The Special Committee on Encouragement of Science Talent in the schools of the Washington area, appointed June 9, 1948, has the pleasure of presenting herewith its report.

The Committee has interpreted its function to be the development of firm recommendations for action in the immediate or near future but not necessarily to consider the ways and means by which action can be taken. Further, it has been assumed that the schools referred to are public, private, or sectarian high schools, colleges and universities within the boundaries of the District of Columbia.

It is the opinion of the committee that recognition of science talent is a necessary first part of any program of science talent encouragement. The limited resources, both financial and human, of the Academy impose the necessity of expending those resources only for the encouragement and fostering of a certain demonstrated minimum science talent rather than in a broad program looking toward recognition and development of all latent science talent in the area. The committee states its opinion that recognition of talent should occur during the early years of high school, with encouragement of the recognized talent reaching a maximum of effort in the high school-college transition years, continuing at high level through the sophomore college year, then decreasing to a minimum at the baccalaureate stage. This system would provide for discovery of talent at the earliest practicable stage of its development and insure maximum encouragement at the most critical period of the potential scientist's career. The committee has considered the problems involved in the discovery and recognition of scientific talent.

It has been the experience of others who have engaged the problem of recognition of talent that the use of tests, competitive exhibitions of the products of talent, and similar means of selection is difficult, requires elaborate staging with an accompanying large expenditure of time and effort, and is quite expensive. The committee doubts that the Academy would desire or is in a position to undertake an independent talent search of the required magnitude. As an alternative the desirability of affiliating with the National Science Talent Search, sponsored by the Westinghouse Electric Corporation, has been examined. The committee is assured that such an affiliation would be welcomed and that no responsibility or obligations other than those desired by the Academy would be assumed. The Academy would have made available to it the results of the ratings of local area contestants in the national competition for use in the selection of recipients of Academy recognition and encouragement.

The Academy now participates in the annual Washington Science Fair which encompasses the entire high school population of the area. Expanded participation in the Science Fair would provide more opportunity to recognize and encourage science talent in the early high school years.

It is the opinion of the committee that the problems of recognition of science talent in the Washington area can be solved by affiliation with the National Science Talent Search and expanded participation in the Washington Science Fair.

Encouragement of science talent once recognized may take many forms. The committee believes that, in any case, its principal objective should be to foster, guide and support the development of scientific talent to a point from which the individual with the talent can continue "on his own steam".

Encouragement may be physical, in the sense of providing ways and means for further training or education in scientific disciplines; such as, awards of scholarships, fellowships or other financial subsidies, or provision of opportunities to work in research institutions. It may be mental, in the sense of providing intellectual stimulation; for example, by providing opportunities for association in an intimate manner with competent, mature scientists in various fields. Lastly, it

may be psychological, in the sense of influencing development indirectly; for example, by the award of certificates or minor honors to set apart individuals on a basis of achievement. Obviously these forms may, and probably should, be combined. The committee believes the association of minds to be the most desirable fostering method. It recognizes the idealistic aspect of that point of view, although the method has been employed frequently, particularly when exceptionally talented young people have spontaneously made their own contacts. The factor of spontaneity is of utmost importance to the method's success, since the contact is likely to fail of achievement if the student or matured scientist feels a loss of independence. Recognition of the human aspects of the problem appears to lead to the necessity of including other forms of encouragement. In this connection it is the opinion of the committee that the use of financial rewards should be considered as the least desirable form of encouragement.

Consideration also has been given to the recent report of a Special Committee on a Junior Washington Academy of Sciences, published in the JOURNAL **38**:(6): 220–222, June 15, 1948, which outlines the value of a Junior Academy in the encouragement of science talent as well as the functions of such a group. It is the opinion of the committee that a Junior Academy, governed by a small committee of senior Academy members, would provide an eminently suited mechanism for encouraging young science talent in consonance with the principles discussed above.

The question of Academy awards for achievement has been considered in conjunction with participation in the National Science Talent Search. If the Academy is to participate in the Search it must be prepared to recognize outstanding local talent in some material fashion. The committee believes that public award of a certificate of merit at a meeting of the Academy would constitute suitable recognition, and would be consonant with the resources of the Academy.

The committee therefore recommends:

1. Affiliation with the National Science Talent Search as a local sponsor, at the earliest practicable moment; and public award of Certificates of Merit to selected outstanding local participants in the National Science Talent Search.

2. That the Academy consider the possibility of expanded participation in the Washington Science Fair.

3. Formulation of a detailed plan for a Washington Junior Academy of Sciences, including a constitution, bylaws, and budget.

4. Appointment of a Standing Committee on Encouragement of Science Talent to implement the above recommendations; this committee to consist of six members, of which two are to be appointed annually for three year terms.

MARTIN A. MASON, *Chairman.*
A. T. MCPHERSON
B. D. VANEVERA
FRANK THONE

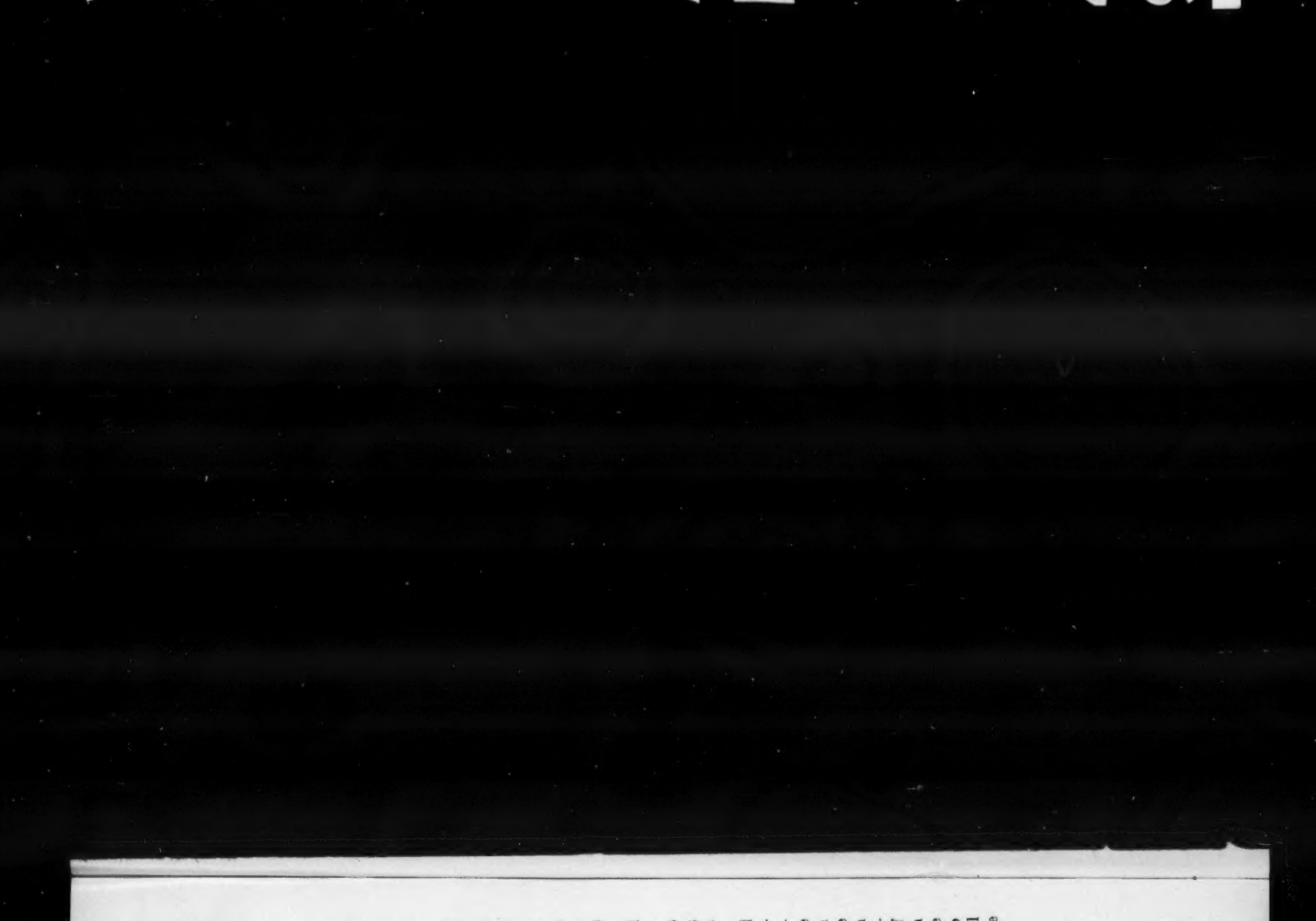
The Board of Managers accepted the report of the above committee and referred the matter of creating a Standing Committee on Encouragement of Science Talent to the Committee on Bylaws for definition and phrasing preparatory to its incorporation into the Standing Rules.

The chairman of the Committee on the Index to the JOURNAL, Dr. W. N. FENTON, presented an informal progress report. He informed the Board that the matter of indexing had been taken up with Miss MARY A. BRADLEY, Technical Editor, Bureau of Entomology and Plant Quarantine, who agreed to index a sample volume of the JOURNAL for the purpose of establishing standards and determining costs, reporting her findings to Dr. FENTON and Mr. OEHSER.

L. L. HARTER was transferred to the retired list of members as of December 31, 1944.

The Secretary announced the death of LOUIS COHEN, of Arlington, Va., on September 28, 1948; and of H. T. HERRICK, formerly of the Bureau of Chemistry and Soils, on October 7, 1948.

The Academy's representative on the council of the American Association for the Advancement of Science, Dr. FRANK THONE, gave an informal report on the Centennial Meeting of the A. A. A. S., which took place in Washington during the middle week of September. He pointed out that he had secured the nomination of Dr. CONDON, an Academy member and Director of the Bureau of Standards, for presidency of the A. A. A. S. for 1949. He also called attention to a meeting of the State academies of science and a paper which he presented on Federal aid to science. It was announced that the 1949 annual meeting would be held in New York during the Christmas week.

The meeting was adjourned at 9:10 P.M.

C. LEWIS GAZIN, *Secretary.*